Founded March 1, 1874—Fifty-One Years of Service

Electrical World

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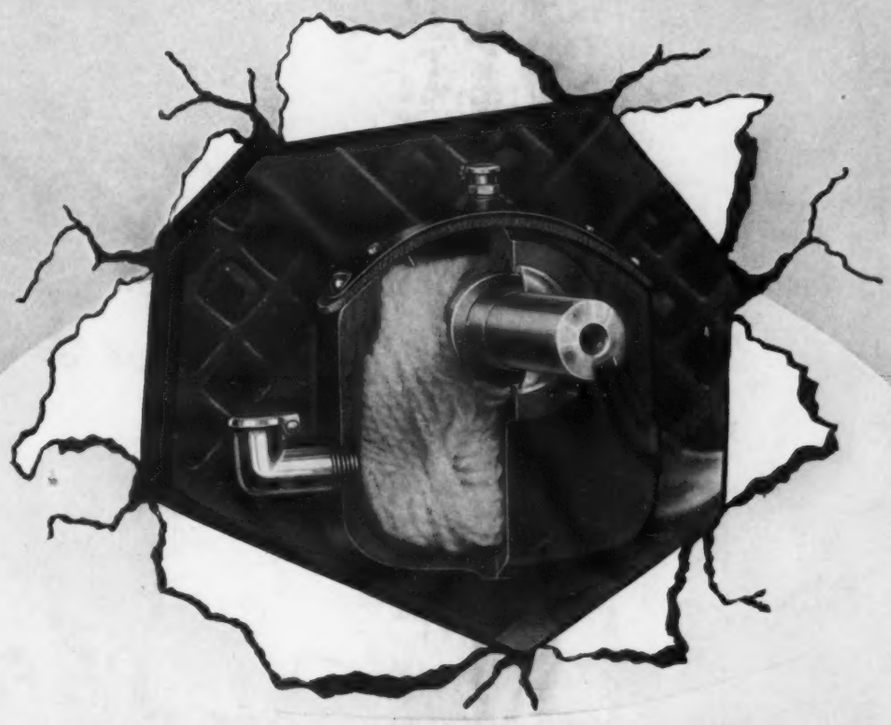


e now prepared to all fractional horse- Century Repulsion Induction Single Motors with the entury Wool-Yarn n of Lubrication is described below.

Bearings are made from the highest grade cast phosphor bronze bearing metal that can be obtained—accurately machined on all dimensions and provided with machine cut figure 8 oil grooves.

Making Good Motors Better

THE INTRODUCTION of the new Century Wool-Yarn System of Lubrication marks a far-reaching advance in the method of lubrication of fractional horse power motors. This new system of lubrication consists of a series of continuous unbroken strands of pure wool-yarn which are "looped" over the bearing surfaces and so packed into the oil well as to comfortably fill it. Because of the capillary properties of the continuous wool-yarn strands, a generous supply of oil is always being delivered to bearing surfaces.

The wool-yarn holds in suspension sufficient oil to properly lubricate the bearings for at least one year's continuous 24-hour-per-day operation. The oil added at the time of installation considerably increases the period that the motor will be properly lubricated, either in continuous or intermittent service. The wool-yarn also acts as a positive filter and permits only clean oil to be delivered to the bearing surfaces.

There is no plug in the bottom of the oil well—leakage tendencies are eliminated and the entire oil supply conserved indefinitely. An oil well cover, with cork gasket lining is firmly screwed down over the oil well slot.

With the addition of this new system of wool-yarn lubrication, Century Fractional Horse Power Repulsion Start Induction Single Phase Motors are practically self-maintaining for a period of years. This, combined with their unusually quiet operation and their "Keep a-Running" ability makes these motors specially desirable for mechanical refrigerators for the home, ice cream cabinets, soda fountains, delicatessens and for oil burner and house pump service.

Century motors are built in all standard sizes from $\frac{1}{8}$ to 40 horsepower—temperature rise not more than 40° Centigrade. Send for Form No. 568, which tells more of the Century Wool-Yarn System of Small Motor Lubrication.

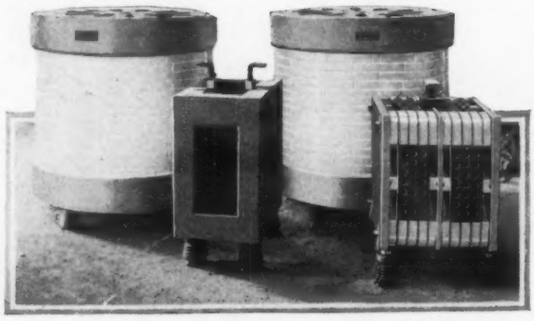
CENTURY ELECTRIC COMPANY

For more than twenty years at

ST. LOUIS, MO., U. S. A.

29 Stock Points in the United States and More Than 50 Outside Thereof

⅛ to 40 H.P. Century MOTORS ⅛ to 40 H.P.



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Another of the Super Power Plants
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Electrical World

THE CONSOLIDATION OF ELECTRICAL WORLD, ELECTRICAL ENGINEER AND AMERICAN ELECTRICIAN

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W. H. ONKEN, JR.

Editor

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The Elimination of Waste

THE tendency of civilization is to destroy itself. Egypt, Greece, Carthage, Rome, all occupied their place in the sun until inefficiency and slothfulness undermined them and they fell victims to more virile and less wasteful peoples. Primitive man, however ignorant, was, once the savage state had been left behind, instinctively provident. Waste, squandering and indolence were the marks of the barbarism he was leaving behind just as they were of the effete civilizations whose place he was to take.

In modern life and industry, however, waste is more complex than it was in the days of old. Waste today includes time, material and effort. That which the industrial chemists salvage we now deem to be not waste at all, but raw material, albeit the refuse from some manufacturing process. Modern science has made its reclamation possible. Superpower in the electrical industry means a more intensive use of investment and a lesser use of labor and material. Economy is its guiding principle. Simplification and standardization in industry lead to greater production, lower costs and the elimination of non-essentials. They are in keeping with the times. Though slow of adoption, they will eventually commend themselves to all industry. Gatherings similar to that of the industrial chemists at Baltimore last week and that of the National Civic Federation at its "industrial round table" in New York last Saturday help to focus attention upon the economic crime of waste and to hasten its elimination.

The Use of Convention Papers

THEY are at work right now in the East Central Geographic Section of the National Electric Light Association digging up some interesting information about the use that is made of convention reports by central-station men. Chairman S. D. Heed, who is vice-president of the Union Gas & Electric Company, Cincinnati, has instituted a study among the companies of that region to find out what is being done to apply and take advantage of the products of association committee work and the printed papers of associations and also what benefits are derived.

This is an important consideration, for a very large sum of money and time aggregating a great value are expended annually on these industry activities. Nobody doubts that it is worth while. The value of this self-education through research and contact has been demonstrated a hundred times. Nobody questions it once he has given the matter thought, but there is a question as to how thoroughly and effectively the knowledge that comes out of each year's effort is utilized. It is known that many companies use the reports of each N. E. L. A. convention as the textbook for staff instruction through the months that follow, but it is probably true that many other companies stack the papers on the dusty shelf and, diverted by the details of daily "busy-ness," allow them to die of neglect.

Chairman Heed is out after the facts, believing that the experience of at least a few central stations which systematically and intelligently use the reports that each N. E. L. A. convention makes available will point a profitable opportunity and show the way to many other companies which today are failing to capitalize this resource. The results of this study should receive close attention. For a new convention is not far ahead, and plans should be laid to make the most of it.

Radio Breaks the Economic Law and Suffers

THE radio industry has walked in the farmer's footsteps and committed the economic sin of following a good-price year with overproduction—for which retribution, as usual, has followed fast. Although the public had purchased radio equipment in enormous quantities, the selling shut down with alarming suddenness directly after Christmas. The radio season, which should and will grow longer year by year with the improvement of both broadcasting and reception, abruptly ended two months before the expected time and left the radio industry "out on the limb."

The reason for this misfortune is entirely clear. The prosperity of last season attracted to the industry a great many additional manufacturers, jobbers, dealers and new receiving sets. Each newcomer planned his operation on the scale of some successful participator of the year before. In consequence there were suddenly injected into the industry too many producers, distributors and retailers and a great overstock of merchandise. Then came the fatal error that is too common in the history of distribution. Manufacturers, long on stock, went over the jobber's head and sold in volume at cut prices to department and chain stores, and these flooded the market with bargains, demoralizing the public appreciation of radio values and freezing up the stocks on dealers' and distributors' shelves.

It is not a surprising thing for this to have happened in so young and enthusiastic a business. It need shake no one's confidence in the future stability of the radio industry. But this present misfortune, in which so many electrical men are more or less involved, should not be allowed to pass from memory before it has registered a very fundamental lesson. And that is that there must be order and responsibility in distribution. For no manufacurer who in an emergency bypasses the jobber and the dealer on whom he relies for an essential service in ordinary times and who dumps goods into the market through a cut-price channel can expect to escape the whirlwind that he sows.

Overproduction brings loss to many. But if excess

goods, temporarily reduced in price, are released through the established trade, with a fair rebate on stocks already on the wholesalers' and retailers' shelves, the market can still be held under control and the situation righted in due time. Fortunately, the fore part of the season was exceedingly prosperous to the radio industry. Much of the present chaos might have been relieved, however, by more consideration for the preservation of orderly distribution.

Making Unit Costs Valuable

UNIT costs of central-station construction were attacked in a recent engineering conference as of little value. This pronouncement by high technical authority points a moral even though it does not adorn a tale. The object of the conference was to get at some cost-per-kilowatt data for first-class generating plants of today and of a decade ago, and the results were not very satisfactory. Very properly, it soon developed that little real comparison could be had between the stations of the pre-war era and those of today. Sizes of generating units have increased; higher steam pressures, stage heating, more complete switchboard apparatus and bus protection, heavier-duty circuit breakers and modified fuels have come into daily practice, and to cap the climax the purchasing power of the dollar has fallen off most sharply.

Out of all the discussion, however, came the conclusion that the modern investor in central-station generating plants gets a great deal for his money in the way of increased efficiency of equipment and superior reliability of performance. This was a byproduct of the discussion and need not be enlarged upon at this moment except to hearten the engineer and executive responsible for raising the large sums now required for plant development by first "selling" their necessity to the financiers in control of company purse strings.

Returning to the unit-cost issue, let us emphasize anew the vital importance of accompanying such data by qualifying information in attempting to use them comparatively. Some standard of comparison is much needed, and the ability of the mind to visualize unit costs challenges the engineer to put more time on such studies than he has hitherto been able to do. There must be more discrimination in making comparisons, more recognition of the great differences so often existing in regard to fuel storage facilities, switch-house sites, water supplies, "take-offs" of circuits by air or by underground transmission and many other things.

Here is a plant, for example, in its initial stage of development, with perhaps 14 per cent of its ultimate capacity about to go into service. Its present cost per kilowatt is almost $200, whereas if it were to be extended at once to its ultimate rating the cost would drop to about $120. About 40 per cent of the initial investment to date is for future needs, as in the coal field, fuel-handling plant, property cost and other outlays. Now, if these points are recognized in interplant comparisons, useful approximations can be established, and if the investments at various times are subdivided and subjected to unit analyses, much good can be derived. We still may be a long way from justly evaluating engineering ability as expressed in unit construction costs, but we are on the road to suggestive figures by which to check designs and locate unusually favorable or unfavorable factors in project development, as the case may be.

Value of Protective Equipment Not Always Realized

TO DERIVE full benefit from the elaborate relay protection found on all large systems today it is necessary that the fullest co-operation exist between those responsible for the proper functioning of such equipment and the load dispatcher. Too often the dispatcher will so operate a system as to render protective apparatus practically useless. Lines and relays assuring several sources of supply to a substation may have been provided, yet the dispatcher will be found to be utilizing only one line and holding the others in reserve. If anything should happen to this one line, an interruption to service will occur, whereas if advantage had been taken of duplicate lines and loops the relays would clear trouble that might occur on any of the circuits without causing unnecessary interruption.

In view of the rapidly increasing complexity of transmission networks, those responsible for the proper functioning of relays should have a voice in determining the manner in which the system is operated if the full value of protective equipment is to be realized. And, on the other hand, the relay engineer must have a proper appreciation of the problems of the operating engineer and the load dispatcher if protection is to be had under the many operating "set-ups" encountered in system dispatching.

Lighting Fixtures and Spherical-Bulb Incandescent Lamps

THE advantages of standardization and reduction in number of types are apparent for incandescent lamps as well as for other manufactured products. The so-called "ball-lamp" fixture has been quite prevalent in display rooms and fixture catalogs for several years, and, naturally, incandescent lamps with spherical bulbs had to be considered by lighting interests. However, a recent survey of residence lighting indicates that not more than 7 per cent of the incandescent lamps in use in homes are of the spherical type.

The best lighting practice in the home demands that all lamps be shaded. Although this ideal has not been reached in the residential field, only about 15 per cent of the bulbs in the rooms where decorative fixtures are used are without shades of some kind. It is true that a large percentage of these shades are not satisfactory from the viewpoint of proper lighting; nevertheless, any kind of a shade decreases the importance of the shape of the bulb. The campaign for shaded light is bearing fruit so that eventually the spherical-bulb lamp will be of no special interest in the home.

From the viewpoint of proper lighting, so-called "ball-lamp" fixtures should never have been introduced for use in homes and other places where persons depend on these unshaded lamps at close range and for long periods. No further proof is needed of the indifference of fixture designers and manufacturers to the precepts of proper lighting in the home than the flood of so-called "ball-lamp" fixtures during recent years. Many of these fixtures were designed without shade holders, and the fact that the spherical-bulb lamp was an essential part of the design is proof that the use of shades was not intended.

This tendency is retrogressive. It is true that there are places in large interiors where frosted lamps with-

out shades are not particularly objectionable, but fixtures without shades in the home are undesirable. It is reassuring to learn that, even with the prominence of the "ball-lamp" fixture during recent years, only a very small percentage of the fixtures in the homes at the present time are of this type. If the fixture makers, the lighting interests and the public can be taught that shaded light is a cardinal principle of proper lighting in the home, the lamp with the spherical bulb will cease to enter the problem.

Analysis of Outages

THE analysis made of steam-turbine outages a few years ago by the prime movers committee of the National Electric Light Association focused the attention of some companies on the necessity of making such studies regularly so as to avoid the causes of trouble and thereby insure greater return from the investment. The need of doing this is extending to waterwheels, as evidenced by the survey under the supervision of the Pennsylvania Electric Association and the hydraulic power committee of the N. E. L. A. The station logs necessary to give this information also provide the information which the operating company should have if it is to benefit from experience.

It is logical to conclude that if causes of outages of any equipment are analyzed, the operator can more readily guard against their recurrence. How far to go in this analysis is an economic problem. It may hinge chiefly on the cost of the equipment or the effect on continuity of service of having the equipment out of service, or both. Companies which wish to get the greatest return from investment in equipment and avoid discontinuities in service will seriously consider the analysis of causes of outage, at least in connection with apparatus which represents a big investment or constitutes an important link in the chain of production and distribution. Analysis of the causes, however, will not alone bring results. Inspection, operation and maintenance will have to be definitely based on the outcome.

Accuracy of Electric Meters Best Assured by Commission Rule

THE Legislature of Texas, a state where electric light and power utility companies are not under commission control, has passed a law empowering the state government to test meters and supervise meter testing, and delegating the details of the work to the Department of Weights and Measures. This law is of vital consequence to the public utilities not only in Texas but in any other state which may be influenced by the precedent thus set. Its purpose as officially interpreted is to afford the public the same protection in purchasing electrical energy that it now has in purchasing commodities sold upon the basis of volume or weight. It aims to protect honest customers and honest utilities alike and to prosecute both companies which allow their meters to run fast and customers who divert energy or tamper with the meters to make them run slow.

No electric light and power company will object to these expressed purposes. None the less, there is danger that the law may prove a step toward bureaucracy. Might it not have been better if the Texas Legislature, instead of passing it, had extended the jurisdiction of its Railroad Commission to other utilities? It has been held many times by the courts and by the public utility commissions themselves that the latter have no concern with the management of companies. The commissions' province is to insure proper service and proper rates. In most states adequate protection against fast meters has been afforded the public by the commissions through specifying the maximum interval between tests of certain kinds of meters in certain services, the maximum error allowed and the penalties. Because electric meters are more likely to run slow than to run fast, most light and power companies would of their own volition test these instruments periodically to avoid losses to themselves, so that the occasional meter which runs fast would be speedily detected and rectified without the intervention of any state agency. None the less, the co-operation of the commissions is welcome, and so, too, it goes without saying, would be help from them in frustrating the thieves who not only defraud the public service company but also injure the honest consumers, for the latter, like all purchasers of commodities, must pay in increased prices for losses from the dishonesty of others.

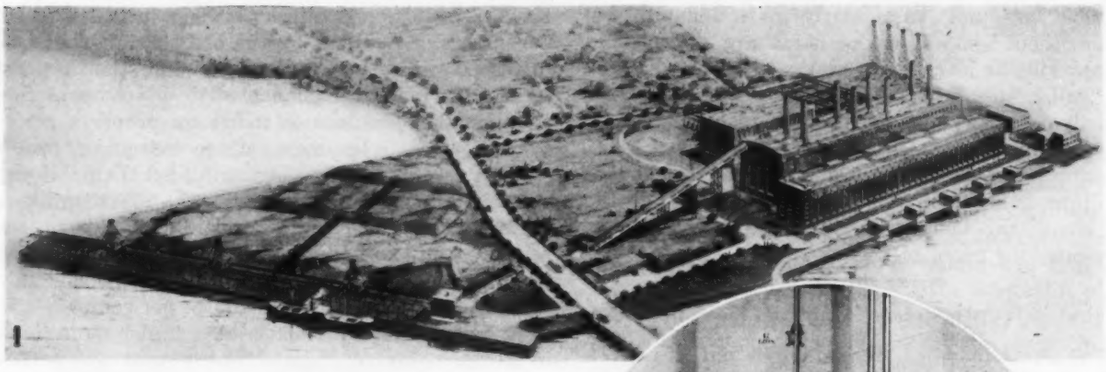
Commercial Aspects of Good Voltage Regulation

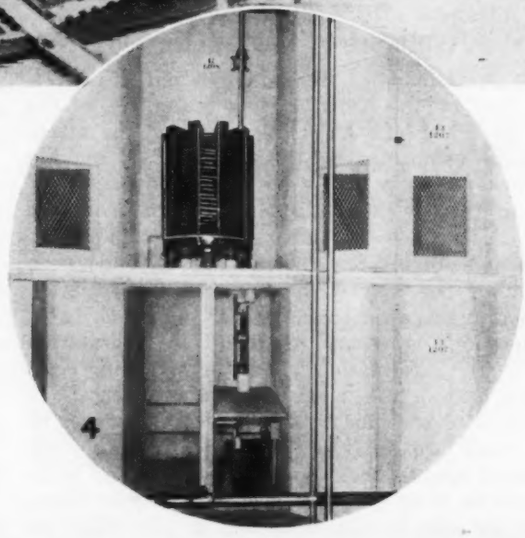
CENTRAL-STATION commercial men will do well to study voltage conditions and requirements more closely in their efforts to obtain more business from hotels, mercantile establishments and factories. The standards of regulation which are permissible vary more or less with the class of service, and it is probable that recent progress in lamp manufacture has been influential in turning the minds of utility men away from this subject in its more competitive aspects. The modern gas-filled lamp will stand so much abuse that voltage regulation is not discussed as frequently in electrical gatherings as was formerly the case.

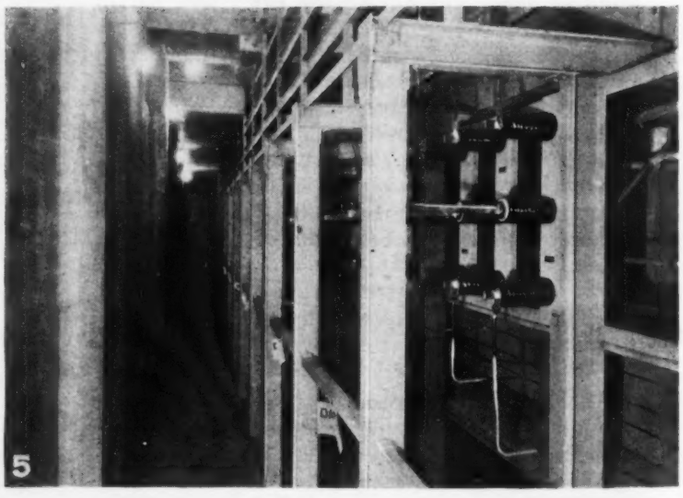
Supplementing recent comments in these columns upon hotel-room lighting, it may be said with truth that the voltage regulation in not a few of the latest and most costly hostelries is far from good. Often the fluctuations are decidedly perceptible to the eye and are virtually continuous. The resultant flickering is annoying to every electrical man and bodes no good to the lay guest's vision, if long maintained. Every hotel which prides itself on its appointments and service should provide steady illumination for its customers, Small high-speed, engine-driven generators reveal their faults in regulation to the discerning eye of the central-station man in so many cases that it will pay the power engineer seeking to take over this class of business to make a few voltage readings at the lamp sockets.

In business and manufacturing establishments the field for study of voltage regulation and allied wiring requirements is very attractive. Code limitations of the pressure drop, carrying capacity of wires, wattage per branch circuit, etc., have long interested central-station men and wiring contractors and will continue to do so in one form or another as new devices are developed for the consumer's use and as diverse applications and varied times of operation multiply. Analyses of present service conditions and possible betterments of service to be brought about by the introduction of central-station energy into all sorts of establishments may well include a more intimate study of voltage regulation than has been customary in the past.

Weymouth to Operate on 13,600 B.t.u. per Kilowatt-Hour

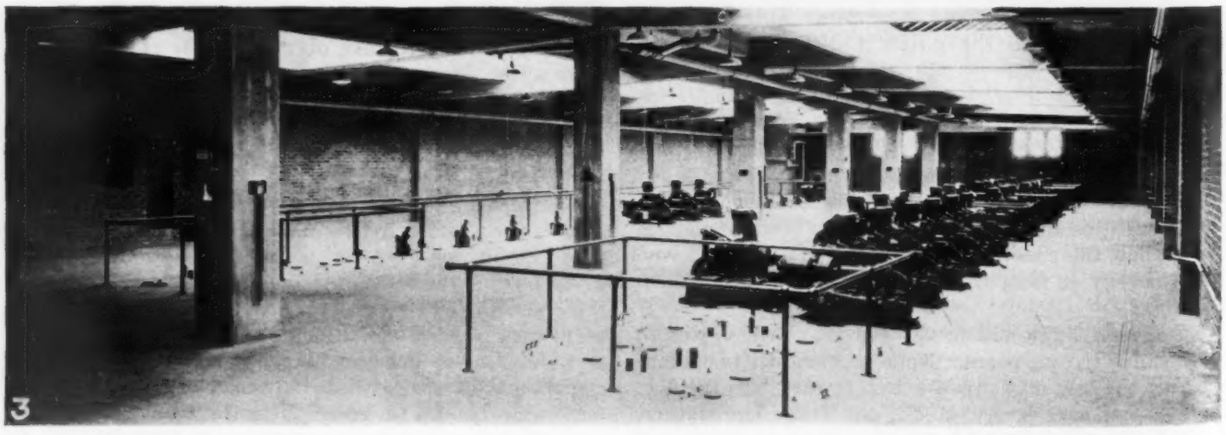






THE first station to use a 1,200-lb. steam-pressure boiler and turbine in conjunction with a 375-lb. system is the Weymouth plant of the Edison Electric Illuminating Company of Boston. This station also represents the best practice in the design and arrangement of an isolated-phase switchhouse. It is expected that the station under best conditions will produce a kilowatt-hour of electricity for 13,600 B.t.u.

1. General view of the complete Weymouth development.
2. The conduit room in the switchhouse.
3. The mechanism room in the switchhouse.
4. A typical reactor compartment.
5. The test bus in the basement of the switchhouse.



Pioneer Engineering at Weymouth Station

Twelve-Hundred-Pound Steam Pressure Installation Co-ordinated with 375-Lb. System to Insure Maximum Plant Economy — Electrical Features Designed to Realize Unusual Reliability and Flexibility of Service

By E. W. NORRIS,* M. J. LOWENBERG*
and T. E. PENARD†

WEYMOUTH station is the logical outcome of the development of the art of electrical generation and distribution. When this company began operations in 1886, its first station, consisting of horizontal non-condensing engines belted to small direct-current generators, was necessarily built in the heart of the intended supply district. As the district extended it was necessary to build other stations of the same character. The first advance over this practice was the erection of a station on tidewater where it was possible to use condensing engines. Here were installed the first vertical engines connected directly to generators still operating at low tension.

The next step was the use of alternating current at high tension instead of direct-current, three-wire units. This enabled the company to locate its next plant in the outskirts, still on tidewater, but where land was considerably cheaper. The next and a most important development was the introduction of vertical turbines, followed by the horizontals of modern type.

The last two stations had the benefit of fuel delivery from oceangoing boats, with ample condensing water. The location was ideal so long as the service was absorbed by Boston and its immediate surroundings. As it became necessary to transmit energy to more distant communities the disadvantages of carrying this energy under the streets of Boston became apparent. It was seen that the L Street location would soon be used to capacity, and it was decided that the next installation should be located so that electricity at high tension and in large quantities could be transmitted to interior towns without going through Boston. So Weymouth was chosen, with its deep-water location and convenient site from which to transmit to the load centers of the Edison territory.

To insure a comprehensive development, all the leading stations east of the Mississippi River were visited before construction began, and increased acreage was purchased. Upon the present land a plant of even 600,000 kw. rating can be built if desired. The general practice of the modern station had been to use steam pressures not exceeding 400 lb. A number of companies were experimenting with higher pressures but none had considered exceeding 600 lb. We decided to take a bold step and go in one jump to 1,200 lb. This is to be accomplished as described in the article here printed by superimposing upon the ordinary station pressure a high-pressure boiler and turbine, and although this portion of the plant is not yet in operation, we have every reason to believe that it will add distinctly to the operating economy of the station and mark a decided step in advance.

High-tension lines can be run from Weymouth into all parts of eastern Massachusetts without encountering any large city. The plant has apparently solved the generating problem of the company for many years to come. It is a credit to the company, to its designers and to its constructors.

C. L. EDGAR,
President the Edison Electric Illuminating Company of Boston.

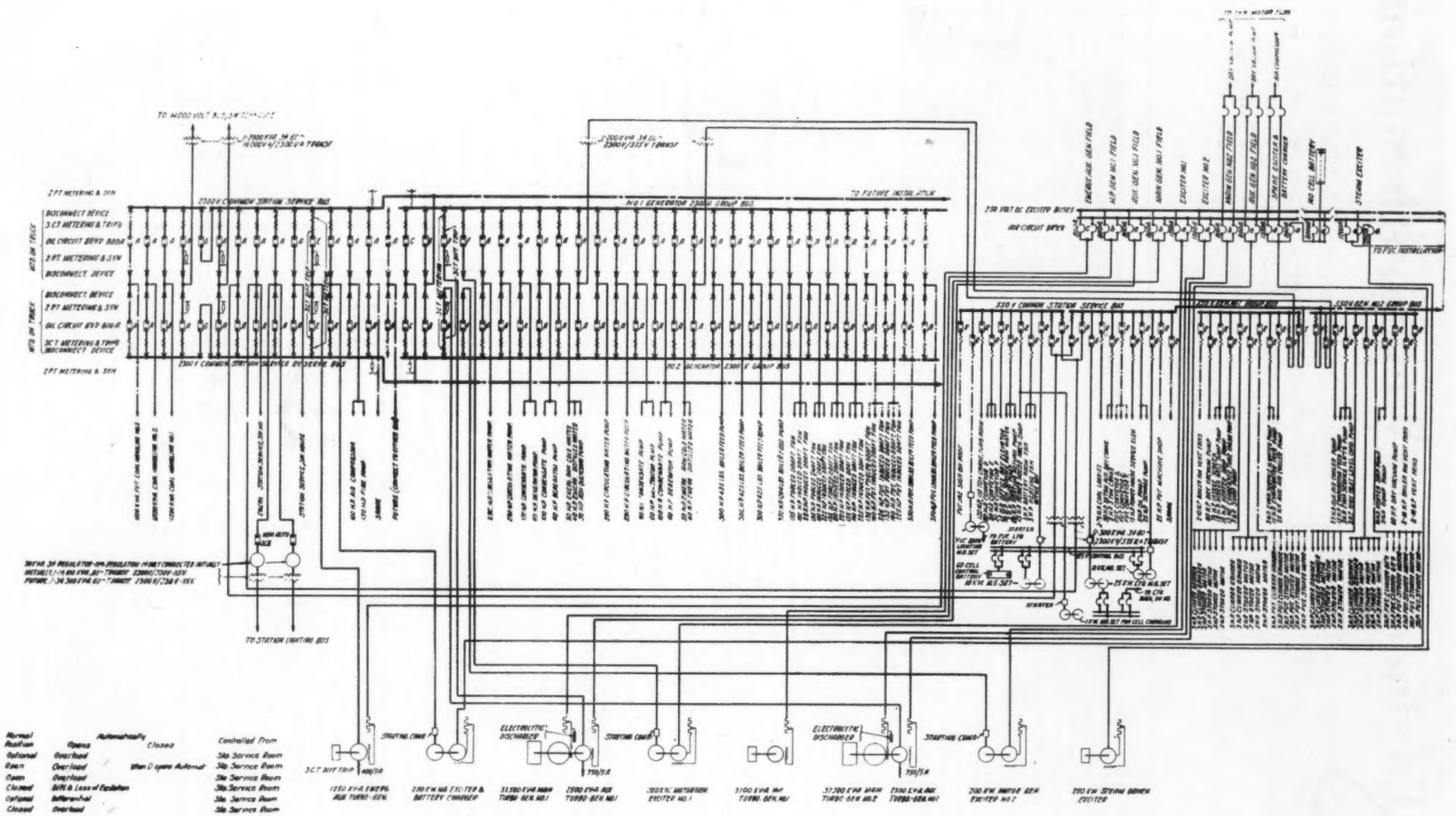
THE Weymouth generating plant of the Edison Electric Illuminating Company of Boston is the first central station to utilize commercially a steam pressure of 1,200 lb. per square inch. This pressure will be superimposed upon a 375-lb. system which began service January 17, 1925, and it is estimated that the ultimate possibilities of this combination under ideal load conditions will be 13,600 B.t.u. per kilowatt-hour with coal having a heat value of 14,400 B.t.u. per pound. The realization of economies of this order will be influenced considerably by the extent to which a constant base load can be allocated to Weymouth and the proportional use of the high-pressure equipment in plant extensions. Development studies indicate that Weymouth will become the base-load station of the system within a very few years, functioning as a true superpower plant in the New England network.

A general description of the plant appeared in the ELECTRICAL WORLD for July 7, 1923, page 9. The present article is devoted to unusual details of the installation, which was designed and built by Stone & Webster, Inc., Boston, under the supervision of I. E. Moultrop, assistant superintendent of construction of the Edison company.

Weymouth is a tidewater plant on a channel of Boston Harbor about 7 miles south of the company's 195,000-kw. station at L Street, South Boston. Sixty-three acres provides ample space for future expansion and fuel storage, the condensing water supply being unlimited. The initial development consists of one 2,480-kw. high-pressure and two 30,000-kw. normal-pressure generating units. An ultimate capacity exceeding 400,000 kw. can readily be installed by extending the present plant along unit lines. Weymouth will deliver energy at 115,000 volts into a ring transmission system to traverse the suburban area west of Boston and will also transmit at lower voltage to important nearer load centers.

Weymouth will serve a typical lighting and power load with a load factor of about 40 per cent. Machines of 30,000-kw. rating were found best suited to present requirements. Had the reheat cycle been adopted for the plant as a whole, the type and size of load to be carried would have necessitated daily shutdowns, and there were other disadvantages. For a portion of the plant, suited especially for base-load operation, reheating offered attractive possibilities, and it was determined upon for a 1,200-lb. turbo-generating unit exhausting through a reheater in the high-pressure boiler setting which will bring the steam temperature back to 700 deg. F. and discharge it into the main steam header supplying the basic 375-lb. units. The cost-per-kilowatt estimates for the combined 375-lb. and 1,200-lb. installation show no greater investment than for the 375-lb. plant because the high-pressure installation comprises only a small portion of the plant and the resulting increase in plant capacity brings the unit cost down to the basic figure. The estimated cost of the initial development of 62,480 kw. is about $13,000,-

*Stone & Webster, Inc., Boston.
†Edison Electric Illuminating Company of Boston.

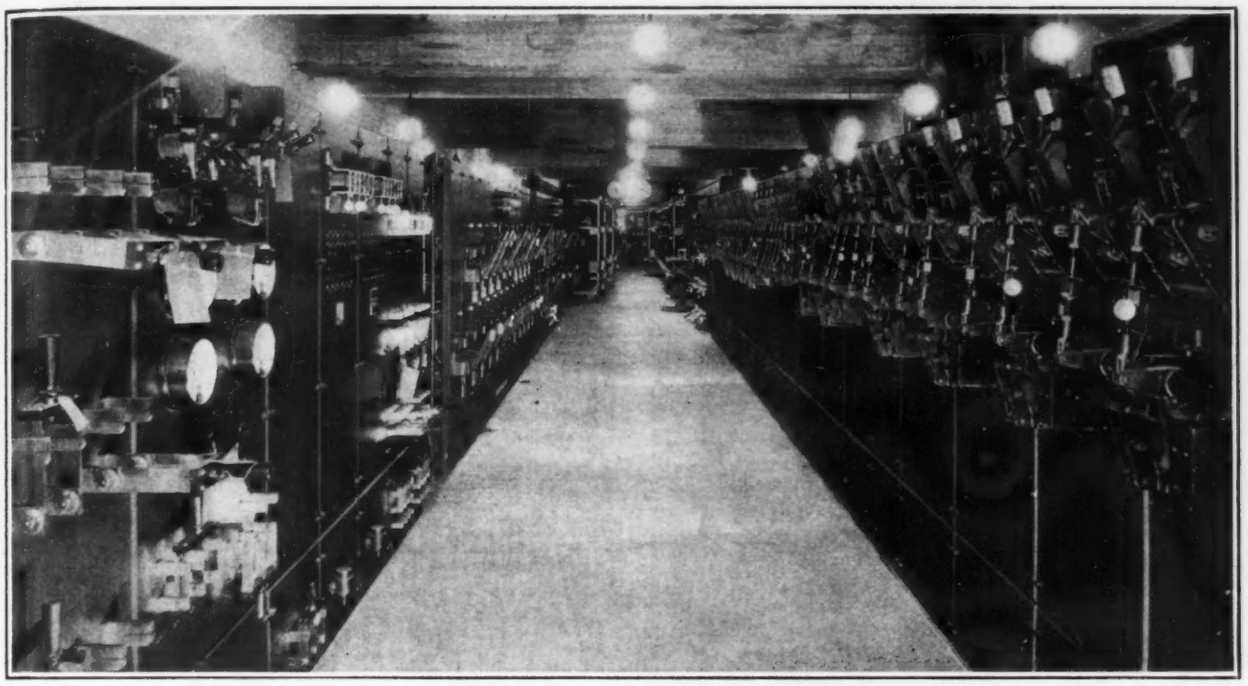

TO 44000 VOLT BUS
2-1500 KVA, 3Φ, 60 ~ 44,000 V/2300 V TRANSF
2-1500 KVA, 3Φ, 60 ~ 2300 V/333 V TRANSF
2 PT. METERING & SYN
DISCONNECT DEVICE
3 CT. METERING & TRIPS
OIL CIRCUIT BRKR. 600 A
2300 V COMMON STATION SERVICE BUS
NO 1 GENERATOR 2300 V GROUP BUS
TO FUTURE INSTALLATION
250 VOLT DC EXCITER BUSES
600 CIRCUIT BREAKER
MAIN GEN NO 1 FIELD
AUX GEN NO 1 FIELD
MAIN GEN NO 2 FIELD
AUX GEN NO 2 FIELD
EXCITER NO 1
EXCITER NO 2
SPARE EXCITER
BATTERY CHARGER
440 CELL BATTERY
STEAM EXCITER
TO PDC INSTALLATION
2300 V COMMON STATION SERVICE RESERVE BUS
NO 2 GENERATOR 2300 V GROUP BUS
550 V COMMON STATION SERVICE BUS
550 V GEN NO 1 ARMATURE BUS
550 V GEN NO 2 ARMATURE BUS
STARTER
TO PDC LTG BATTERY
60 CELL BATTERY
TO STATION LIGHTING BUS
STARTING CUBICLE
ELECTROLYTIC DISCHARGER
3 C.T. DIFF TRIP
1250 KVA EXCITER AUX TURBO-GEN
750 KW MA EXCITER & BATTERY CHARGER
31,250 KVA MAIN TURBO GEN NO 1
2500 KVA AUX TURBO-GEN NO 1
2000 KW MOTOR EXCITER NO 1
3100 KVA AUX TURBO GEN NO 2
37,500 KVA MAIN TURBO GEN NO 2
2500 KVA AUX TURBO-GEN NO 2
700 KW MOTOR GEN EXCITER NO 2
750 KW STEAM DRIVEN EXCITER

Breaker	Normal Position	Automatically Opens	Automatically Closed	Controlled From
A	Optional	Overload	When D opens Automat-	Sta Service Room
B	Open	Overload		Sta Service Room
C	Open	Overload		Sta Service Room
D	Closed	Diff & Loss of Excitation		Sta Service Room
E	Optional	Differential		Sta Service Room
F	Closed	Overload		Sta Service Room
G	Open			Sta Service Room

P	Optional	Overload, DC Trip with CT		Sta Service Room
R	Closed	Overload, Series Trip		Sta Service Room
S	Closed	Overload, DC Trip with CT		Sta Service Room
T	Open	Overload, DC Trip with CT		Sta Service Room
a	Optional	Reverse Current		Operating Room
b	Optional	Differential		Operating Room
c	Optional	Differential		Sta Service Room
d	Optional	Differential		Operating Room
e	Optional	Diff & Loss of Excitation		Sta Service Room

Notes:-
1. All oil circuit breakers connected to 2300 volt buses are electrically operated truck type
2. For 44000 volt bus switch house, see Main One Line Wiring Diagram Dwg F 88013
3. For station service, switch house, see Sta Power Wiring Diagram Dwg F 88016
4. For station lighting, see Light Wiring Diagram, Sheet No1 Dwg.
5. All oil circuit breakers connected to 550 volt buses are manually operated switchboard type

MAIN ONE-LINE DIAGRAM OF WEYMOUTH STATION, SHOWING THE LAYOUT OF TWO 30,000-KW. UNITS AND ONE 2,480-KW., 1,200-LB. UNIT

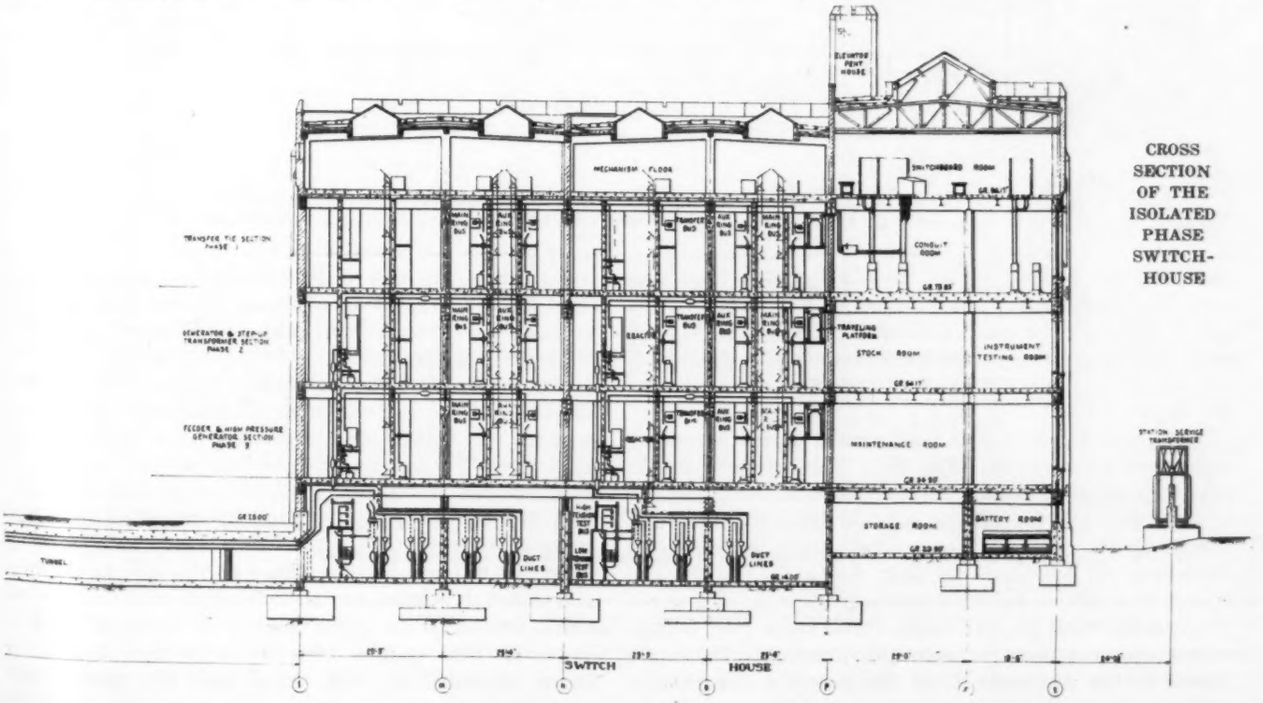


THE 250-VOLT SWITCHBOARDS IN THE STATION SERVICE ROOM

000, of which about 40 per cent is allocated to future requirements.

The coal-storage plant was designed on the basis of a 350,000-kw. station and as an emergency storage for the system. The present development has a capacity of 100,000 tons. Small-bucket, high-speed unloading towers were required to keep down demurrage charges on large steamers and to unload fuel from craft with small hatches. Two 400-tons-per-hour electrically operated hoisting towers with 2-ton buckets are installed, with shuttle discharge conveyors from which coal can be delivered to an emergency pile at the rear of the tower trestle, direct to the plant or to storage. The coal-handling plant and storage are on the north side of the property, and the plant is reached by a conveyor system with an ultimate capacity of 800 tons per hour which passes under a highway and delivers fuel to the overhead bunkers of the boiler house via an inclined gallery.

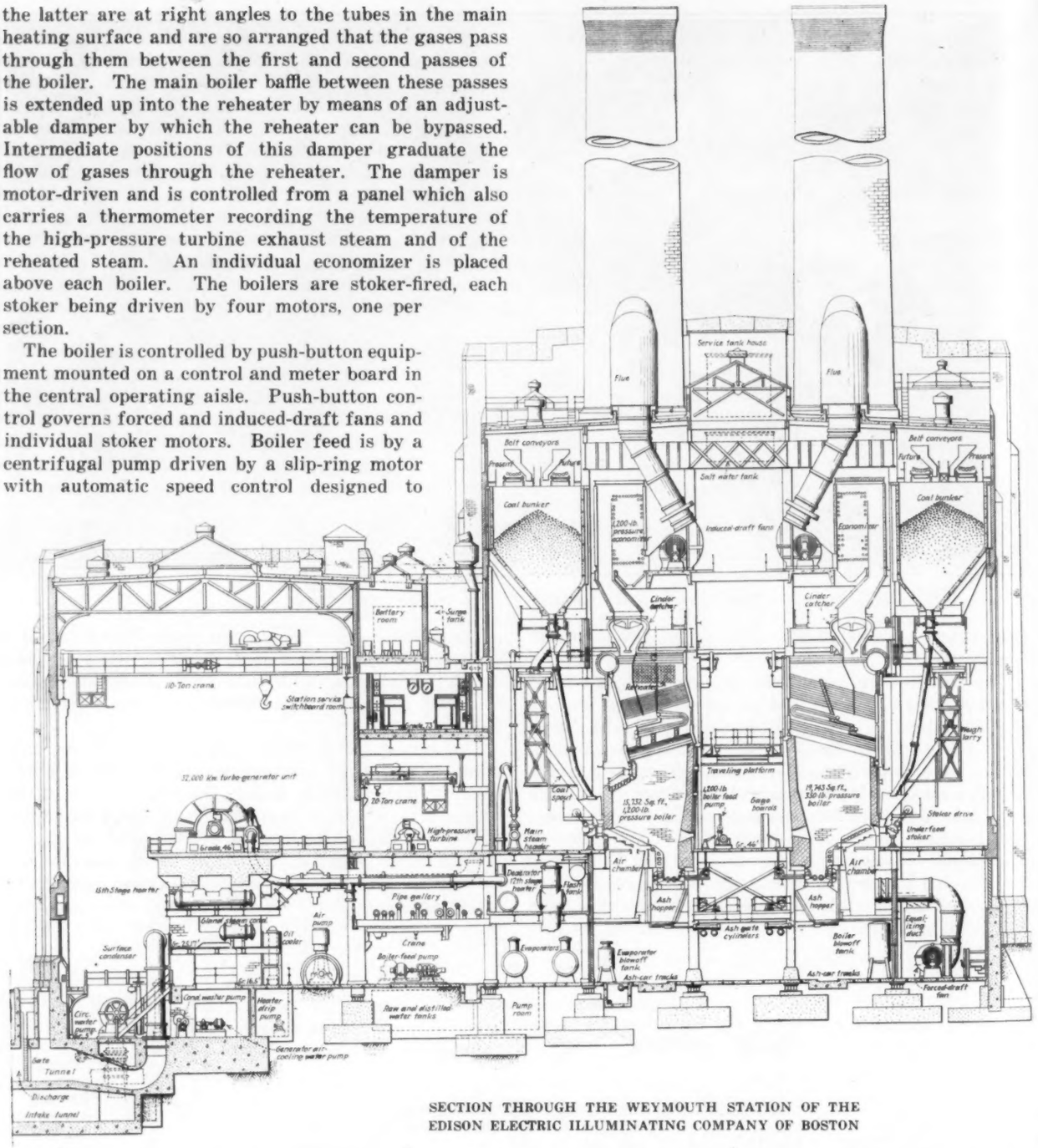
The initial boiler installation consists of one high-pressure and three normal-pressure Babcock & Wilcox boilers. The 1,200-lb. boiler, described briefly in the previous article, is a modification of the conventional cross-drum type. Its heating surface consists of 2-in. tubes, 15 ft. long, arranged in three passes. The tubes are separated into upper and lower banks, with a primary superheater between. Above the upper bank is the secondary superheater or reheater. The tubes of



CROSS SECTION OF THE ISOLATED PHASE SWITCH-HOUSE

the latter are at right angles to the tubes in the main heating surface and are so arranged that the gases pass through them between the first and second passes of the boiler. The main boiler baffle between these passes is extended up into the reheater by means of an adjustable damper by which the reheater can be bypassed. Intermediate positions of this damper graduate the flow of gases through the reheater. The damper is motor-driven and is controlled from a panel which also carries a thermometer recording the temperature of the high-pressure turbine exhaust steam and of the reheated steam. An individual economizer is placed above each boiler. The boilers are stoker-fired, each stoker being driven by four motors, one per section.

The boiler is controlled by push-button equipment mounted on a control and meter board in the central operating aisle. Push-button control governs forced and induced-draft fans and individual stoker motors. Boiler feed is by a centrifugal pump driven by a slip-ring motor with automatic speed control designed to



SECTION THROUGH THE WEYMOUTH STATION OF THE EDISON ELECTRIC ILLUMINATING COMPANY OF BOSTON

maintain the desired excess pressure on the feed system, this excess being a maximum of 875 lb. above the 425 lb. used on the main feed lines serving the normal pressure units. For preliminary and standby operation, a steam-driven centrifugal feed pump is mounted near the boiler.

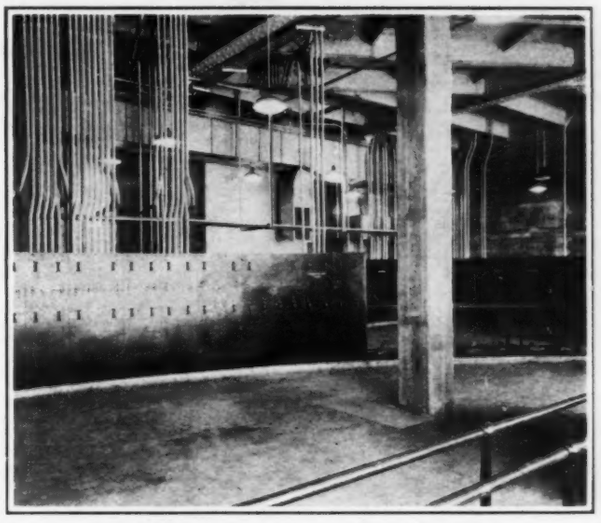
The cross-drum is provided with a series of safety valves set to blow at 1,200 lb. The primary superheater is protected by a safety valve on its outlet set to blow at 1,190 lb. There is a possibility that, after operating, the seats of these valves might be destroyed, rendering it necessary to shut down the boiler and reseat the valves before resuming service. To avoid undesirable wear of the main valve seats two telltale valves are provided to warn the fireman. These are placed in the discharge from the primary superheater and are of small diameter and set to blow at 1,170 lb. Gate valves are placed between these and the steam connection to facilitate shutting off and restoring the telltale valve service in case reseating of a telltale valve becomes necessary.

The 1,200-lb. turbo-generator, which is of General Electric design, is built along conventional lines except that its parts have been strengthened to withstand the high pressure and temperature to be used. The unit will operate at 3,600 r.p.m. and is of the horizontal four-bearing design. The turbine is of the straight impulse, twenty-stage type. Two heavy steel castings form the top and bottom halves of the casing and inlet and exhaust nozzles are cast integral with the bottom half. Owing to the great density of steam at 1,200 lb. (a cubic foot weighs between 2 lb. and 3 lb.), the steam passages are very small and the casing itself is very moderate in size. The governor is of the

centrifugal type, operating a balanced governor valve through a pilot valve and hydraulic cylinder. An emergency overspeed trip is provided to close the throttle valve under excess r.p.m. In case the throttle valve is tripped closed, a trip-opening bypass valve connected to the main steam line on the boiler side of the throttle discharges steam at line pressure into a special throttling nozzle and expansion chamber which reduces its pressure to 375 lb. At the same time water is admitted from the main boiler-feed line to a de-superheater mounted at the discharge of the expansion nozzle. In this way the bypass steam is reduced to saturation temperature and is discharged into the turbine exhaust beyond a check valve which prevents its return to the turbine. From this point the steam flows as in normal operation to the reheater, where it is brought to its original temperature and discharged to the main steam header. This protects the reheater during emergency and when raising steam or shutting down the boiler.

The piping of the high-pressure installation is simple. It consists of a single high-pressure line connecting the primary superheater outlet nozzle on the boiler to the turbine throttle, an exhaust line connecting the turbine exhaust to the reheater inlet on the boiler, and a third line connecting the reheater discharge on the boiler to the main steam header. Schutt & Koerting gate, trip throttle, trip bypass, drip and boiler-feed valves, with Pittsburgh high-pressure steam pipe and Payne Dean motor-driven valve control, are used.

The steam ends of each two main units are adjacent, with one condensing-water intake and tunnel serving two units. From an operating point of view two units and their auxiliaries are considered as one group. Condensate is normally used to cool the generator air discharge, with supplementary cooling sections using salt water during low loads and low vacua. The condensate and boiler-feed system has been laid out to eliminate unbalancing by flow between units, each unit having a separate condensate return to the feed system from its hot well to the surge tank. Provision is made for heat recovery from the turbine oil coolers and gland leak-offs.

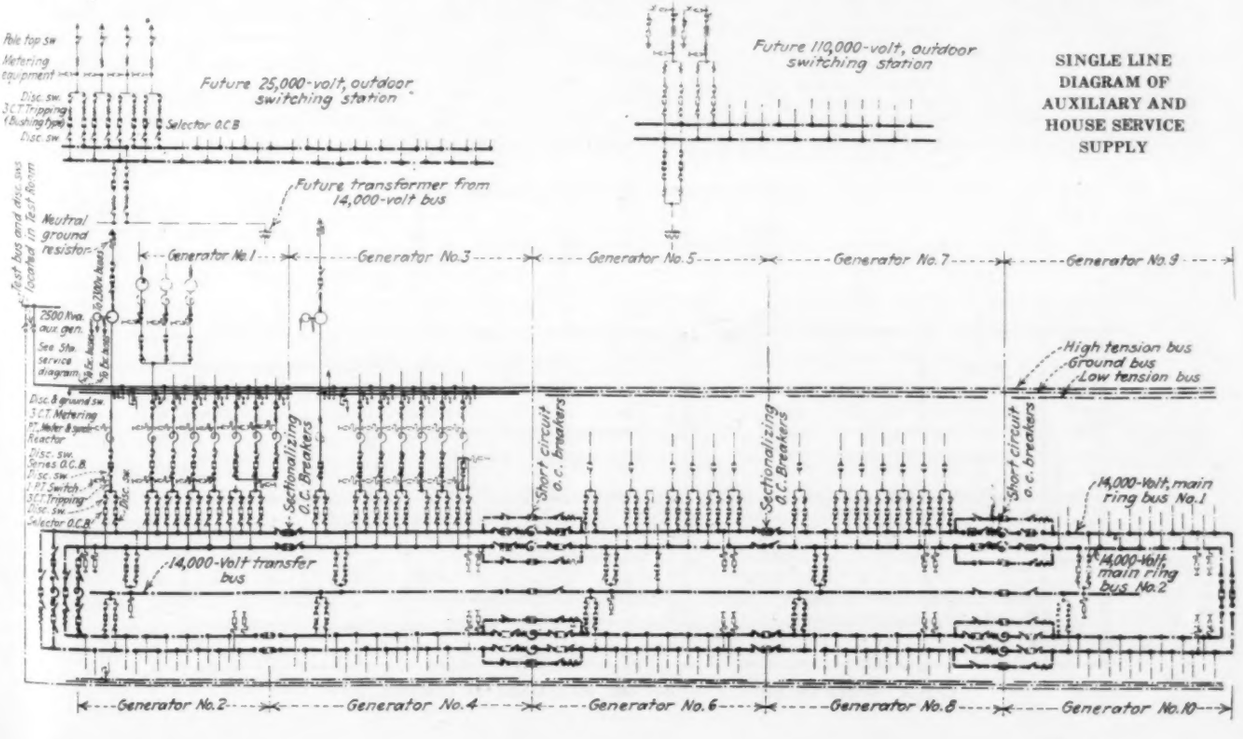


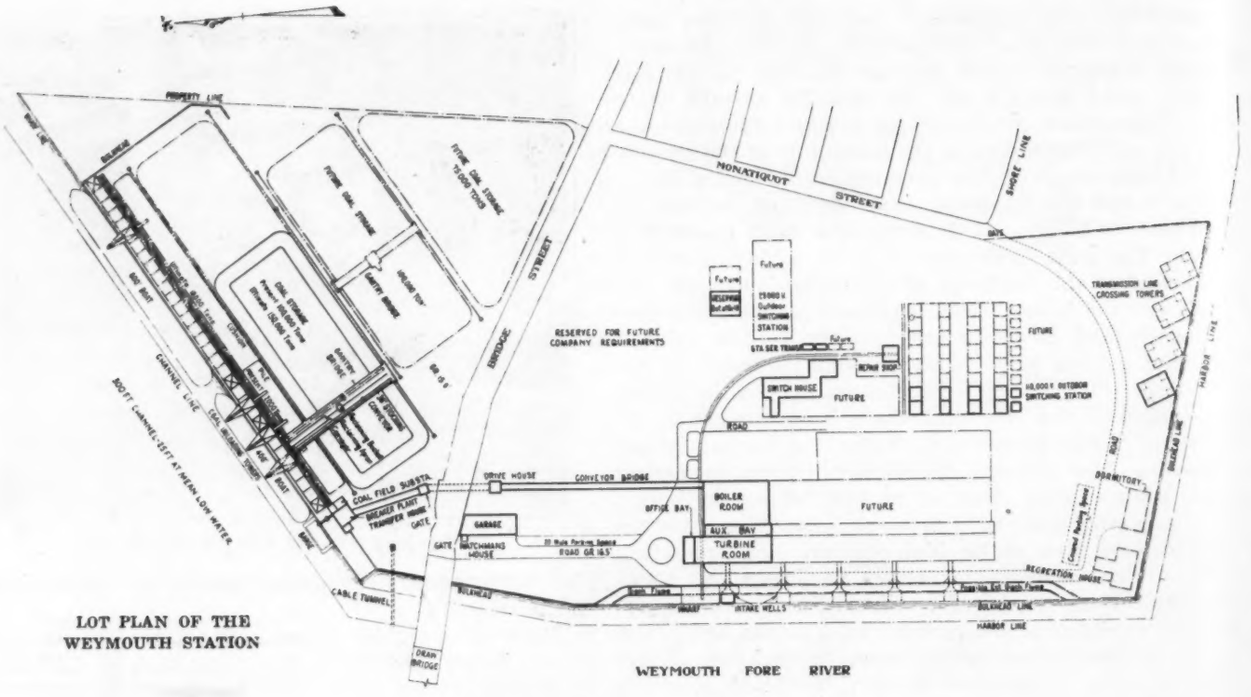
A CONDUIT ROOM IN THE SWITCHHOUSE

Each main turbine drives a 30,000-kw., 80-per-cent-power-factor, 14,000-volt generator and a 2,480-kw., 80-per-cent-power-factor, 2,300-volt auxiliary generator on a common shaft.

A description of the switching scheme was given in the earlier article. An isolated switchhouse, about 145 ft. long x 55 ft. wide, with four stories and basement, is designed to permit extension in width as well as in length. All incoming and outgoing circuits pass through the basement, which contains test buses and a high-tension test room, with appropriate switches. The three floors above contain the buses, switchgear and reactors, each phase being isolated to a single floor. Stress on the rear walls of the oil-breaker cells is eliminated by a special casting attached to the breaker, and the short-circuiting switch carrying the main current is located in the same cell as the breaker instead of in

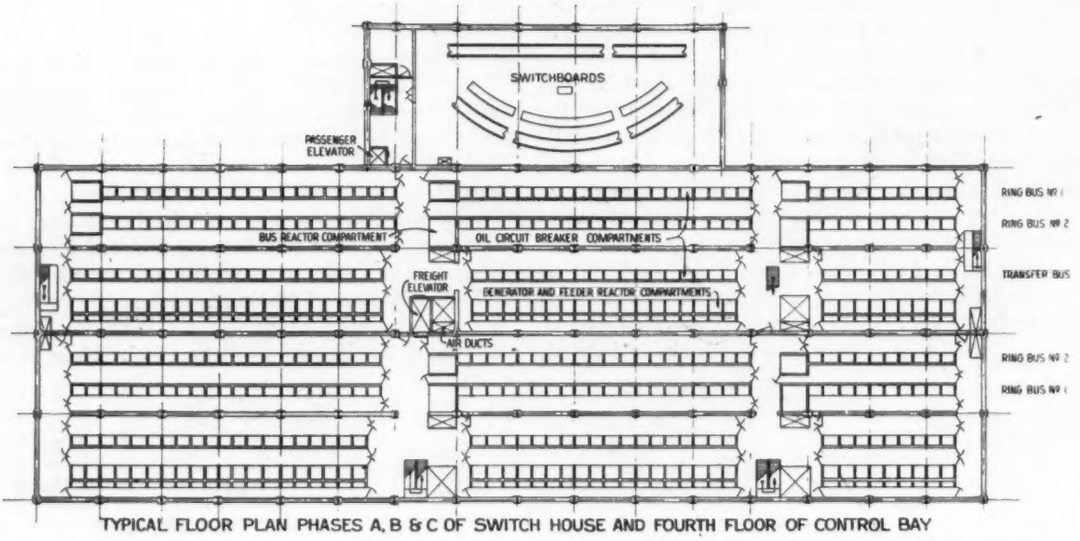
SINGLE LINE DIAGRAM OF AUXILIARY AND HOUSE SERVICE SUPPLY





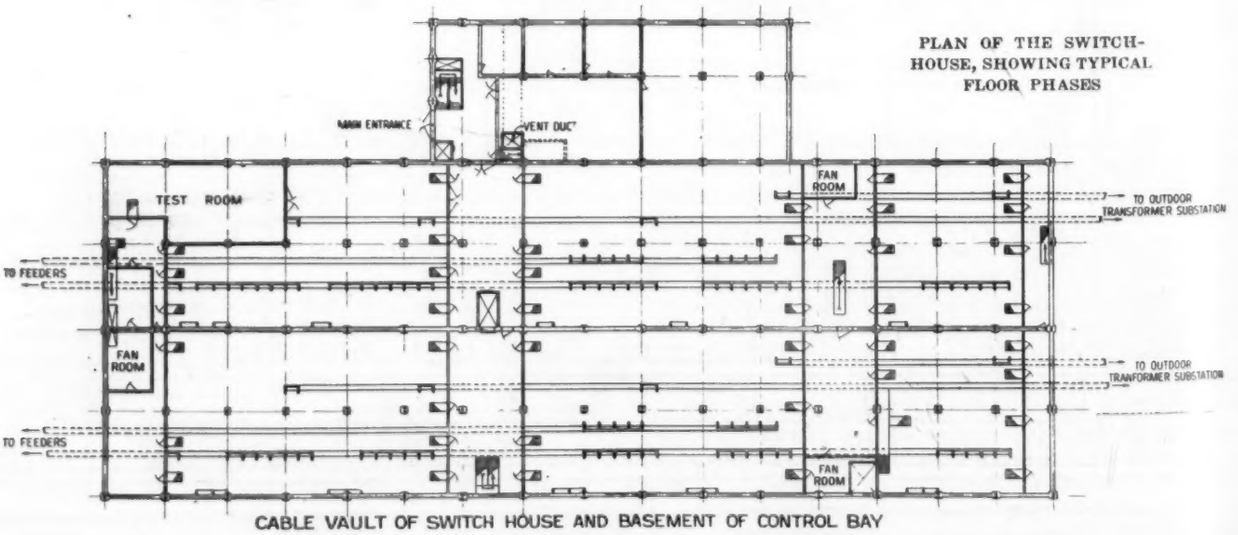
LOT PLAN OF THE WEYMOUTH STATION

WEYMOUTH FORE RIVER



TYPICAL FLOOR PLAN PHASES A, B & C OF SWITCH HOUSE AND FOURTH FLOOR OF CONTROL BAY

PLAN OF THE SWITCH-HOUSE, SHOWING TYPICAL FLOOR PHASES

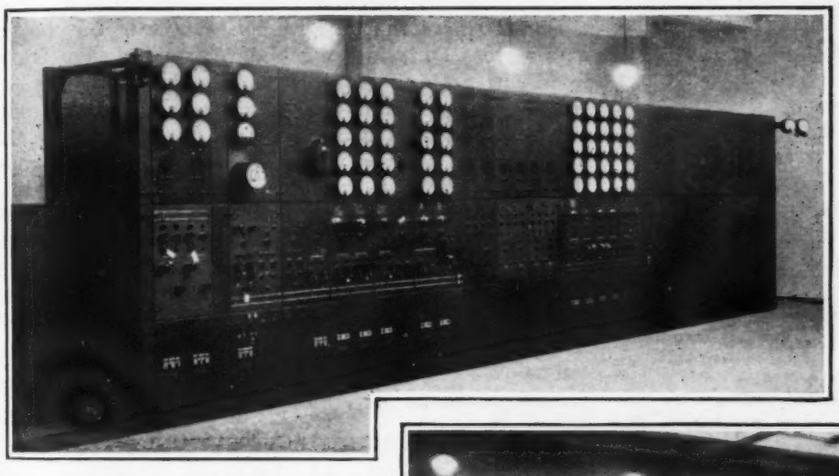


CABLE VAULT OF SWITCH HOUSE AND BASEMENT OF CONTROL BAY

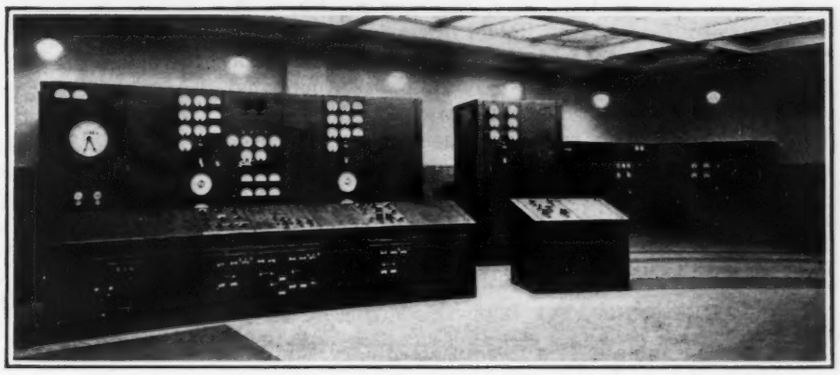
the disconnecting-switch compartment. With 14,000-volt bare copper the operating rods are protected by bushings from being destroyed by accidental arcs, and provision has been made for the use of insulated joints in the rods. Insulator and disconnecting switch inspection is facilitated by movable platforms.

Breaker and switch-operating mechanisms are installed on the fourth floor. These are interlocked for sequence protection. The switchboard room adjoins the mechanism room on the same floor, and on the floor below the former is a conduit room through which control circuits are brought to the switchboards and by which changes easily can be made.

A 140-cell exciter battery of 2,106-amp. thirty-minute discharge rate has been provided for emergency use. All exciters are connected through selector air circuit breakers to duplicate exciter buses, and the fields of all synchronous generators are connected through selector breakers to these buses, which are also equipped with sectionalizing switches. Station lighting is available from three-wire direct-current motor-generator sets, from a 140-amp.-hr. storage battery and from the alternating-current buses through transformer and regulator units. Automatic supply of direct-current lighting follows any interruption of the alternating-current supply. Grounded neutrals and single-pole cabinet switches are used.



FEEDER CONTROL BOARD



GENERATOR AND BUS TIE CONTROL BOARDS IN WEYMOUTH STATION

The most economical auxiliary scheme was found to be to drive such apparatus by alternating-current motors, resulting in the use of smaller cables and conduits, with corresponding reduction in wall and floor thicknesses. The layout was simpler than with direct current, and the use of an auxiliary generator on the main generator shaft not only offers a power source of maximum efficiency but permits unit operation through a group bus, insuring high reliability. The estimated auxiliary normal power required by each 30,000-kw. unit is about 800 kw., with 450 kw. for the boiler-house auxiliaries necessary to operate one turbo-generator. One-half the boiler-room auxiliaries for three high-pressure generators adds 300 kw., making a total of 1,550 kw. under normal conditions. In emergencies, with maximum boiler forcing, the load on one auxiliary generator may reach 2,100 kw. All 2,300-volt circuits are controlled by truck-type switchboards. These trucks are equipped with oil circuit breakers redesigned for finger-type contacts and with minimum clearances of 5 in. between phases and 3 in. to ground. High-capacity feeder breakers without reactors were used because smaller breakers with individual feeder reactors would have cost more and would also have introduced a large voltage drop in starting motors.

In case the auxiliary generator fails, the differential relays trip the generator breaker and close a selector oil breaker to the station service bus, thus keeping power supplied to the auxiliaries. If the field of the auxiliary generator fails, the generator breaker opens and the station service bus breaker is closed. Failure of the main generator also throws the auxiliaries upon the service bus. Even under severe system disturbance it is expected that enough auxiliary load will remain on the unit to prevent overspeed throttle tripping if the load on the main units should be entirely lost.

The motor and control equipment of all auxiliaries upon which the continuity of station output depends is so designed that on restoration of auxiliary power after an interruption the auxiliaries will automatically be restored to service. This is accomplished on squirrel-cage motors of 25 hp. or more by a double squirrel-cage winding permitting the motor to be thrown directly across the line, the starting current being about four times the motor rating. On slip-ring motors an automatic contactor is used controlling the resistance in circuit, and on brush-shifting motors a pilot motor restores the brushes to a starting position. The forced-draft and induced-draft fans are automatically controlled by the combustion-control system.

Energy is distributed from the station through underground circuits at generator voltage, and provision is made for outdoor step-up transformer substations to feed lines at 25,000 volts and 115,000 volts. A submarine conduit of sixty ducts capacity is being built under Fore River in order to avoid the use of submarine cables.

Asynchronous Unity-Power-Factor Motor

New Apparatus Which Has Induction-Motor Performance Characteristics—Brush Failure Does Not Render Motor Inoperative—A Discussion of Power-Factor Correction

By VAL A. FYNN
Consulting Engineer and Patent Adviser, St. Louis, Mo.

THE writer has struggled with adjustable-power-factor motors for many years. His earliest efforts were directed toward producing a single-phase unity-power-factor motor, a first success being scored in the late nineties. Later he did considerable work in multiphase machines, inventing among other polyphase unity-power-factor motors the self-exciting synchronous-induction machine now on the market under the trade name "Fynn-Weichsel," but he still felt that a more desirable solution should be possible.

Close analysis had long ago disclosed the fact that the true solution, at least for the current motor sizes, must be looked for in a non-synchronous machine, but it was only after many years of study that a practical solution occurred to the writer. When it did finally materialize it proved to be surprisingly simple. A polyphase unity-power-factor asynchronous motor is now available, and one object of this article is to describe in a brief manner some of the characteristics of this machine.

The new motor is available in squirrel-cage form, but can just as well be built as a slip-ring machine. E. Ballman, president of the Baldor Electric Company of St. Louis, very kindly undertook to build the first machines for the writer, and it is of interest to note that no development work whatsoever was found necessary in the factory. The very first machine built proved entirely satisfactory and operated exactly as expected. As in the case of the synchronous-induction motor above referred to, the writer had succeeded in absolutely completing the invention on paper, thus entirely eliminating the usually expensive experimental work.

Difference from Ordinary Motor

The new machine differs from the ordinary squirrel-cage motor only in that a very simple phase-compensating circuit is provided which includes a small commutator on the secondary. In Fig. 1 is shown the rotor of such a motor, and Fig. 3 is an illustration of the complete machine. The stator carries the primary, which does not differ from the ordinary primary winding of an asynchronous motor and is therefore quite as elastic, as safe and as convenient as the latter. The compensating circuit is treated as non-existent when operating the machine, which is consequently handled exactly like an ordinary asynchronous motor. All the user has to do in connection with the compensating circuit is to see that worn-out brushes are replaced. If anything does happen to the compensating circuit, and it is not seen what can ordinarily occur outside of the breaking or the wearing down of a brush, the machine continues to operate, simply taking more current—just that current which is taken by the corresponding non-compensated asynchronous motor—and the broken or worn brush can be replaced at any convenient time. Without the use of slip rings the starting performance of the motor can be made the same as that of an ordinary squirrel-cage motor or it can be made to approach that of the corresponding slip-ring machine. There is no sparking at the commutator, and it is thought that the machine is quite foolproof.

Fig. 2 shows the performance curves of one of the new motors built into a standard squirrel-cage frame by doing nothing more than suitably modifying the rotor. Better results can, of course, be had by redesigning the whole machine. Even by making nothing but the most necessary changes it is possible to raise the power factor to unity and to increase the output of the machine by about 20 per cent as compared with its capacity as a squirrel-cage motor. Upon opening the compensating circuit, the machine continues to operate without any interruption whatsoever, but takes the line current indicated by the solid curve i' instead of that indicated by the solid curve i. While the machine can be overcompensated to any reasonable extent, this is not recommended for reasons which will appear later.

Magnetizing Current Only

One of the distinguishing characteristics of this new machine is that the commutator carries absolutely nothing but magnetizing current. Just what this means can be best explained by means of a vector diagram.

Assuming an asynchronous motor with a magnetizing current of 20 amp., a full-load current of 54 amp. and a maximum-load current of 120 amp., the approximate vector diagram of this machine at maximum load is shown in Fig. 4, where existing but small phase differences have been disregarded as immaterial in connection with the point under reference. While the load ampere-turns in this machine are proportional to the vector 0-4 or 2-3, its magnetizing ampere-turns are proportional to the vector 0-2 and are only 17 per cent of the maximum-load ampere-turns. In the writer's new asynchronous machine the commutator carries nothing but the magnetizing current, which is usually about 17 per cent of the maximum load current.

To convert the asynchronous motor of Fig. 4 into a synchronous induction motor of the same maximum load, thus permitting of a direct comparison between the two motors, it is necessary to make the ampere-turns on the secondary of the latter equal to the ampere-turns represented by the vector 0-4. But in a self-excited synchronous induction motor the current for these ampere-turns must be carried by the commutator on its primary, and it is seen that the commutator of the new asynchronous motor carries only about 17 per cent of the current carried by the commutator of the corresponding self-excited synchronous induction motor.

The test results shown in Fig. 2 were obtained with

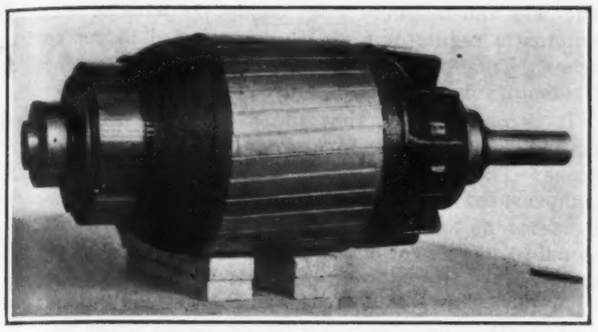


FIG. 1—ROTOR OF FYNN NON-SYNCHRONOUS POLYPHASE UNITY-POWER-FACTOR SQUIRREL-CAGE MOTOR

a standard 7½-hp. six-pole squirrel-cage motor frame. The weight of this standard machine as an ordinary squirrel-cage motor is 324 lb. By adding 14 lb. of material the machine was not only made to operate with unity power factor but to give a materially greater output. A further addition of 15 lb. of steel and iron was necessary to accommodate the ventilating arrangements needed to take full advantage of this increase in

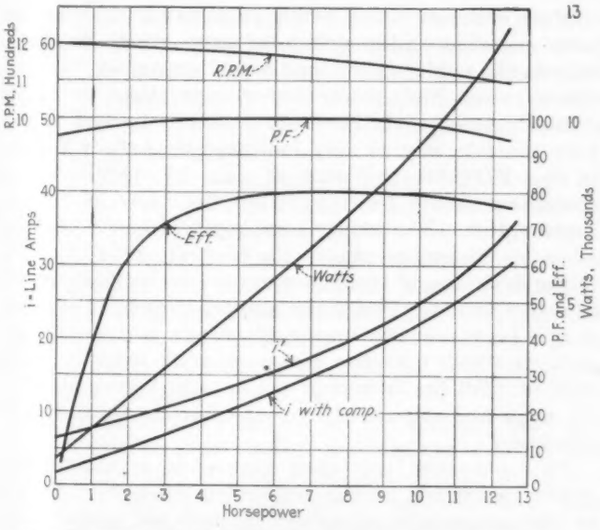


FIG. 2—PERFORMANCE CURVES OF POLYPHASE SQUIRREL-CAGE MOTOR BUILT INTO STANDARD 7½-HP. SQUIRREL-CAGE MOTOR FRAME

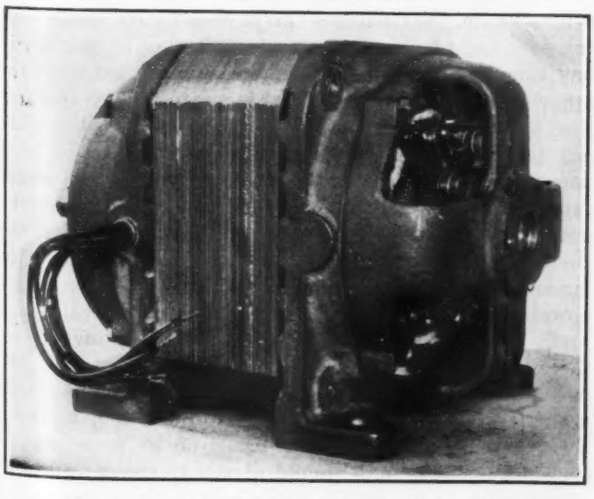


FIG. 3—NON-SYNCHRONOUS POLYPHASE UNITY-POWER-FACTOR SQUIRREL-CAGE MOTOR

capacity. This all means that the new machine can be sold at a very attractive figure down to quite small sizes.

There is no difficulty whatsoever in applying the invention to the very largest motors made, and a full description of the machine, together with the underlying theory, will soon be available.

DEVICES RECOMMENDED

As the matter now stands, the following devices are available for overcoming the low-power-factor trouble, which is making itself felt more and more:

1. *The Static Condenser.*—This is a highly efficient device without moving parts. Condensers are very expensive but appear to be quite reliable. The difficulty with static condensers is that they are extremely responsive to high frequencies; in fact, the higher the frequency the greater their response, with the result that all high-frequency disturbances caused by switching, short-circuiting and the like are apt to be very greatly magnified. It is thought to be very poor policy to allow a large static capacity to be connected to any system, but not much harm can result from the use of a moderate amount of such capacity. Static condensers can be used for group or for individual correction, meaning the neutralizing of the lagging component of a group of motors or that of a single motor.

2. *The Synchronous Condenser.*—This is an efficient but costly apparatus, suitable for group correction but extremely sensitive to network disturbances and liable to fall out of step. It requires attention. It is thought that the ordinary synchronous motor with defined polar projections, now in general use for this purpose, is not well suited to it. Synchronous induction motors, and particularly the separately excited form of such machines, appear to the writer to be clearly indicated for this service. Such machines can be safely left unattended, regardless of line short-circuits and all similar accidents.

3. *Polyphase Motors with Controllable Power Factor.*—Two types of such machines are now available, the self-excited synchronous induction motor and the asynchronous motor with controlled power factor.

The self-excited synchronous induction motor, as now built, carries its primary winding on the rotor, this winding being connected to the line by means of slip rings. The rotor also carries a commutator connected to a secondary winding by means of brushes, and this commutator carries load and exciting currents. If anything happens to this commutator or to its brush gear, the machine is immediately rendered inoperative because the other winding on the secondary is closed along only one axis per pole pair. The inherent compounding characteristic possibilities of the machine are such that it cannot operate at nearly unity power factor at all loads and must operate with leading power factor over almost all of its synchronous load range.

The non-synchronous motor with controlled power factor first described carries its primary winding on the stator and has no slip rings in its primary circuit. Its secondary is provided with a commutator which is quite small and carries only about 17 per cent of the current carried by the commutator of the corresponding synchronous induction motor. If anything happens to its commutator, the asynchronous machine does not stop and does not even falter, but simply takes an increased primary current, that which corresponds to the lower

power factor attaching to the asynchronous motor of the usual construction. It can be started as well as operated without making use of the compensating device. The machine operates with any desired power-factor characteristic and is in particular very well able to operate with nearly unity power factor throughout its load range. It is cheaper, lighter, far more rugged and much simpler than the corresponding synchronous induction motor.

In making use of the apparatus just discussed to improve the power-factor situation, it seems to the writer that certain guiding principles can be observed with advantage.

The use of synchronous or static condensers by the utility company to correct for customers' low power factor is to be deprecated. There was some excuse for this practice so long as unity-power-factor motors and static condensers for local correction were not available. Installing synchronous condensers is penalizing the user of high-grade apparatus and encouraging the use of cheap, low-power-factor motors. In the end both the utility company and its customers suffer. The public utility should not attempt to correct for anything but lagging current taken by its own distribution apparatus.

When dealing with the power-factor problem it is imperative to remember that a leading current produces just as much loss as a lagging current except that the excitation losses in the generators are less when delivering leading instead of lagging current. The aim

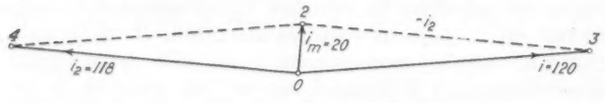


FIG. 4—VECTOR DIAGRAM OF NON-SYNCHRONOUS MOTOR AT MAXIMUM LOAD

should therefore be to carry the smallest possible current on as great a percentage of the distribution system and in as many translating devices as possible.

In correcting the power factor of individual motors the static condenser should be installed as close to the motor as possible. It reduces the line but not the motor current. The same is true of synchronous condensers, but such are not likely to be used for individual power-factor correction.

In correcting the power factor of groups of motors or groups of other translating devices the same thing holds true. Only that part of the system derives benefit from such correction as lies between the condenser, whether synchronous or static, and the central station. The losses in the customer's distributing system and in his motors are not reduced. Unless the motors of a group are always all on when the condenser is in action, the correction back of the condenser will suffer if the capacity of the latter is not automatically regulated. Automatic regulation of static condensers is hardly to be considered.

The use of unity-power-factor motors is the most thorough means of correcting power factor, because when such motors are installed the current is reduced in the motor, in the customer's wiring in his transformers and in the public utility's entire system.

Where non-compensated motors are already installed, close figuring is necessary in order to determine just how to deal with the situation. Individual or group correction may be indicated. If group correction is decided upon, a static condenser may be preferable in one case and a synchronous condenser with or without automatic regulator may be cheaper and better in another. Under some conditions it may pay to replace all the motors by unity-power-factor machines.

It is not thought that the use of overcompensated motors is advisable for power-factor-correction purposes. The efficiency of a motor is highest when it is compensated to unity or to very near unity. Overcompensated motors are less efficient. It seems more rational to correct for power factor by means of apparatus or machines specially designed for this duty.

In the case of new equipment the question of first cost, maintenance and cost of operation must be considered. No strict rules can be laid down, but it will probably be found that with the advent of the new non-synchronous squirrel-cage motor machines up to perhaps 1 hp. are best equipped with static condensers and unity-power-factor motors installed where larger sizes are called for. When it comes to very large machines, part of the demand is likely to be supplied by non-synchronous unity-power-factor motors and part by separately excited synchronous induction motors.

METERING AND RATES

Much difficulty is apparently anticipated in connection with metering and a system of rates which would be fair to the public utility and would encourage the customer to use high power factor apparatus. No great difficulty is seen if the problem is approached in the very sensible way so ably indicated by Arthur Wright in the ELECTRICAL WORLD of Jan. 17, 1924. Power customers should be charged on the basis of current consumption. The utility company will be best served when its customers employ the highest grade of translating devices, and the customers themselves will benefit to a like extent. Under the ampere-hour-meter system it will be to the customer's advantage to use that apparatus which does the necessary work with the least current. All the customer will have to bother about is the price and amount of current taken by the device he purchases.

This one item will then take care of the elusive power factor and of the conversion efficiency. So far as the customer is concerned, he need not bother as to how low current consumption is secured, whether by high efficiency or by high power factor. Knowing the current taken by the apparatus he is considering and the utility's rate, the customer can at once figure the operating cost and positively determine whether or not it will pay him to purchase the higher-grade device. On the other hand, the public utility is protected by the fact that low current consumption is not now possible without high power factor, and it can set its rate on a power-factor basis which will be remunerative under existing load conditions and become more so as the power factor of the system increases—as it will if the customer is encouraged to purchase high-power-factor apparatus. An ampere-hour rate set on the basis of a power factor less than unity will automatically and justly increase the bill of the customer using low-power-factor motors and decrease that of the user of high-power-factor machines, the bonus to the latter reaching a maximum when unity power factor is reached. Such a rate can in many cases be based on an 80 or 85 per cent power factor and should appeal to the state utility commission, to the public utility and to the customer because of its simplicity, directness and obvious fairness.

Oil Maintenance Methods

Decreasing Service Interruptions by Care of Switch and Transformer Insulating Oil—Chemical Changes Not Restored by Present Filtering Methods — Experiences on the Duquesne Light System

By MAX LINN
Maintenance Supervisor Duquesne Light Company, Pittsburgh, Pa.

THE Duquesne Light Company has about 600,000 gal. of transformer oil in service as well as about 200,000 gal. switch oil at its substations, which must be reconditioned at various periods. This at present results in about 250,000 gal. per year being taken to the central treating plant. Much of this oil is being discarded at the present time, although, if reconditioned to a state similar to the new oil, it would in a comparatively short time pay for the installation of the special process and also decrease interruptions.

With the rapid increase in short-circuit currents which must be interrupted by the present-day circuit breakers, the problem of maintaining insulating oil of the proper quality in this equipment has greatly increased, especially where it is subjected to outdoor service, higher voltages and low temperatures or other atmospheric conditions.

In this article comparatively little will be said of insulating oils as applied to transformers, for the reason that less difficulty is encountered if the transformers are not subjected to conditions which will cause sludging and are kept in service during periods of rapidly changing temperatures when condensation might occur due to "breathing," the "breathing" being greater when the change is from air temperature to even light load temperatures.

About three years ago the Duquesne Light Company experienced a great many transformer and circuit-breaker failures. These experiences were attributed to various causes and through an analysis many were found to be due to the condition of the insulating oil. Samples of the oil were taken in all high-voltage transformers, and while the dielectric strength of some was found to be low, a large number were found to be heavily sludged, the sludge being due to high temperature from overloads, overpotential or other abnormal operating conditions.

The sludging has been remedied by correction of the underlying cause, and this attention to the oil as well as to other defects in the transformers has greatly decreased the number of failures.

At the present time service life tests are being conducted of three different grades of transformer oil. To make these tests two installations were selected where the operating conditions would be nearly identical, especially with reference to the load being the same on each unit of the bank, the only difference being that the two banks were of a different manufacture. The A-B-C phase units of each bank contain one of the three different grades of oil. These service tests have been under way for a period of nine months, and while this period of time is too short to give positive results, they are very promising, and it has already been possible to determine which of the three oils indicates the best operating characteristics.

Once every three months the oil is sampled and the samples are subjected to dielectric, chemical and physical tests, which consist of tests for specific gravity, flash, fire and pouring viscosity, precise resistance to emulsification, water, sediment, turbidity, unsaturated hydrocarbons, formolite and sulphur corrosion.

In the past this company used switch oils of two different grades, the only requirement being that they pass a dielectric test of 22,000 volts between 1-in. disks at 0.1-in. separation. The first difficulty experienced was on outdoor circuit breakers containing oil having a congealing point of about —11 deg. On this basis some of the outdoor stations were designed with the idea of using electric heaters in the switch tanks, but this was abandoned as more or less impracticable and an oil having a congealing point of —40 deg. C. was used. While the use of this oil has remedied to a large extent the difficulty of slow switch operation, another difficulty was discovered which was the cause of many circuit-breaker failures, many of these having been attributed to lack of short-circuit-interrupting capacity. This difficulty was due to the accumulation of water in the switch tanks, a matter which caused no particular harm in warm weather, when the water settled at the bottom of the tanks; but in warm weather, if the circuit breaker was opened either manually or on short circuit, the water was stirred through the oil so as to be deposited on the bushings or remain suspended for a time in the oil. On a second short-circuit operation the rupturing capacity was greatly decreased and the breaker failed, or, in the case of simple re-establishment of potential, a flashover or puncture of the bushings would occur.

Effect of Water Freezing in Oil

In cold weather, if sudden freezing occurred, the water in the bottom of the tank would form a cake of ice, which would float upward when the outdoor temperature went above freezing. Moreover, at or below freezing temperature the dielectric strength of the oil would be at a very low value, owing to the moisture in the oil probably forming minute ice particles. These particles, having a lower specific gravity than the oil, would have a tendency to float upward or remain suspended.

The accumulation of water, which was first believed to be largely condensation, was found actually to be mostly leakage of the circuit-breaker top castings. The method of determining this is as follows: The station operator is provided with three 50-cu.cm. glass graduates, in which each day he takes a sample of oil from all three tanks of the circuit breaker. He allows the samples to stand in a warm place in the control room until the next morning, when he records the amount of water on a special report form in the

number of cubic centimeters of water found. In this way it has been found that certain circuit breakers accumulated more water than others. As the records were marked "end tank," "middle tank" and "mechanism end tank," the approximate location of the leak could be found, but the exact location was very difficult to determine. The remedy has been to replace all gaskets using heavy shellac and to paint the top castings thoroughly.

In order to keep the oil in good condition, the maintenance crews inspect the 11,000, 22,000 and 66,000-volt circuit breakers after each heavy short circuit, replacing the oil if it shows a low dielectric test or is badly carbonized. On the 66,000-volt circuit breakers, owing to the larger volume of oil and ordinarily lower short-circuit duty, it is not necessary to replace the oil quite so frequently. This is rather fortunate, as these circuit breakers contain about 2,800 gal. of oil and therefore the work and expense involved are very high.

Once each month the maintenance crews inspect the oil of each outdoor circuit breaker. The water is first drained off until the oil tests at least 20,000 volts; then enough new or reconditioned oil is pumped into the tank to bring the oil to proper gage level. When possible, this work is done without taking the circuit breaker out of service. Of course, the quantity of oil taken out is not sufficient to take the top level much below the bottom of the gage. If the oil is carbonized sufficiently to make it very opaque or give a low dielectric test, it is completely changed, the tank is cleaned and contacts are inspected. For the replacement of the oil in the 11-kv. and 22-kv. breakers a rotary hand pump mounted on a 4-ft. length of 1¼-in. pipe for the intake and a flexible hose for the discharge are used. For the 66,000-volt circuit breakers a rotary power pump with a 5-hp. motor is used. Extreme care is used in wet or damp weather to prevent moisture from getting into the oil, and when possible the work is done in dry weather, although a large amount of oil is changed in wet weather, especially after a storm which has resulted in line trouble. Heavy tarpaulins are used to cover the circuit breakers, drums and pumps. It may be well to state here that dielectric tests are not ordinarily made in wet weather, because, regardless of the care taken, the tests are very variable and far from satisfactory, the moisture of the air getting in the test receptacle being sufficient to give the variable results.

For testing oil in the field a small portable testing transformer having a 110-volt source, applied instantaneously, was first used; but it was found that this resulted in discarding oil which would pass the laboratory test using a variable-voltage outfit. To overcome the difficulty and not use the large heavy sets in the field, a box containing the small portable transformer, a slide resistance and a voltmeter calibrated in kilovolts was constructed. To make certain that the outfit was sufficiently accurate, repeated checks with the laboratory outfit were made, and the comparison was found very satisfactory.

The oil which is found unsatisfactory for service is reconditioned to remove the water and suspended carbon. At first this was largely done in the field, especially on the 66,000-volt circuit breaker, but with the knowledge that the oil should be changed as soon as its condition rendered it unfit for service rather than at a scheduled period—which was at first set at six months—the practice of removing the used oil to the shop and hauling out clean oil was started. A centrifugal filter is used to recondition the oil. This filter was at first set up in a portable house on the job, and while satisfactory in some respects, considerable difficulty was encountered in pumping the oil quickly, especially where the station was on sloping ground and the lift and head on the pump were rather great. The average distance from the 66,000-volt stations to the central plant is about 15 miles, and the shortest time attained for replacing the oil in the 66,000-volt circuit breaker is about six hours.

RECONDITIONING OIL

The Duquesne Light Company has studied and experimented with the various methods of reconditioning oil, all processes being entirely mechanical—the first being the heat and settling method, the second the blotter press and the third the centrifugal filter. The first method has been entirely abandoned. The second is still used largely for cleaning transformer oil preparatory to dehydrating it with the centrifugal filter. The third process is used exclusively on switch oils.

While the above methods remove water and suspended carbon, they still leave the oil in a condition which is far from the original condition of new oil in respect to its chemical qualities, and these qualities have been found to influence the performance of the oil greatly, both in transformers and circuit breakers, though especially in the latter.

These modifications from the original condition are the result of the intense heat of the arc, which results in a great amount of suspended carbon, and other chemical changes, which decrease its "resistance to emulsification." This decrease in "resistance to emulsification" permits the oil more readily to absorb and hold moisture, and while in this condition the rupturing capacity of the circuit breakers is greatly decreased; also, the bushings show a marked tendency to fail from creepage over the surface immersed in the oil.

To overcome these chemical defects, a practical process not only to remove water and suspended carbon, but one which will recondition oil so that it will more nearly pass the specifications for new oil, is badly needed.

Oil received at the central treating plant is now filtered and tested for dielectric strength and also for specific gravity to make certain that no mistake has been made as to its grade. The transformer oil must show a specific gravity of about 0.83 at 15.5 deg. C., and the switch oil one of about 0.90 at 15.5 deg. C. Formerly an intermediate grade of oil was used for indoor circuit breakers, but the use of this oil is being gradually abandoned. This is a great aid in maintaining a sufficient stock, as several grades must be carried owing to the manufacturers of the equipment not assuming any responsibility for the performance of their equipment if oil from another manufacturer is used.

Much trouble with insulating oil is due to lack of care in handling oil drums or other containers. Considerable moisture will accumulate in a drum which has been left in the open with the gaskets loose enough to permit "breathing." The moisture causes the drums to rust and result in low dielectric tests.

Dirty oil containing sludge or carbon if put in a clean drum causes a coating on the inside which cannot be thoroughly removed by ordinary methods. When

clean oil is put in the container, the carbon and sludge, if not thoroughly removed, contaminate the clean oil and thus lower its dielectric strength.

The Duquesne Light Company for a number of years has used large colored tags (a different color for each grade), with the grade and condition of the oil printed on them. These tags are shellacked to the end of the drum and have been of great assistance to the men in the field. Further to improve the quality of oil, it is intended to paint all drums which are used for new or reconditioned oil a red color and drums used for dirty oil a black color. Precautions such as these may seem superfluous, but it is known that the oil manufacturers from years of experience have found many such safeguards necessary to assure the quality of their product.

It may be hoped that the day is not far distant when the performance of insulating oil under service conditions will be so well known that standard specifications will be set up and agreed to by all the large manufacturers of electrical equipment. By this means the user will know exactly what to expect and will not be required to stock more than two grades of oil.

The National Electric Light Association has set up standards for transformer oil which the manufacturers have agreed to in so far as their physical constants are concerned, but, as previously stated, the manufacturers still do not assume any responsibility for their equipment when oil from a competitor is used. In the proceedings of the fortieth convention of the National Electric Light Association a treatise (revised in 1922) on the properties, treatment, inspection and testing of insulating oils has been given. This information still holds good for transformer oils and to a large extent for switch oils, but it is felt that more information should be published on insulating oils for circuit breakers.

Letters from Our Readers

Advantages of Wisconsin Electrical Code

To the Editor of the ELECTRICAL WORLD:

Referring to the editorial entitled "Uniform Ordinances and Standards Needed," appearing on page 653 of the March 28 issue of the ELECTRICAL WORLD, the writer has a few comments to make. In the first place, he is thoroughly in sympathy with the effort to secure a reasonable degree of uniformity in inspection ordinances and laws governing electrical installations and uniformity in the interpretation of the National Electrical Code. As a matter of fact, we have achieved a reasonable degree of uniformity in the State of Wisconsin already. Some years ago a model ordinance was drafted and made available to municipalities desiring to enact wiring inspection ordinances. Today quite a number of the ordinances in effect are based upon this model ordinance. Moreover, the Wisconsin State Electrical Code provides a minimum standard of electrical construction for the entire state.

While the National Electrical Code primarily is designed to prevent fires from electrical causes, and the safety-to-life features are therefore subordinated and insufficient, state and municipal authorities are responsible for the safety of the public from both standpoints. Hence it is practically a necessity that governmental authorities add to the local electrical requirements matters pertaining to safety which are not found in the National Electrical Code. It would appear to the writer that a prerequisite for real success in obtaining the very much desired national uniformity will be one of two things: Either (1) the National Electrical Code must be broadened out so as fully to cover the casualty hazard as well as the fire hazard, or (2) a combined electrical safety and fire code must be developed by properly combining the present National Electrical [fire] Code with the National Electrical Safety Code.

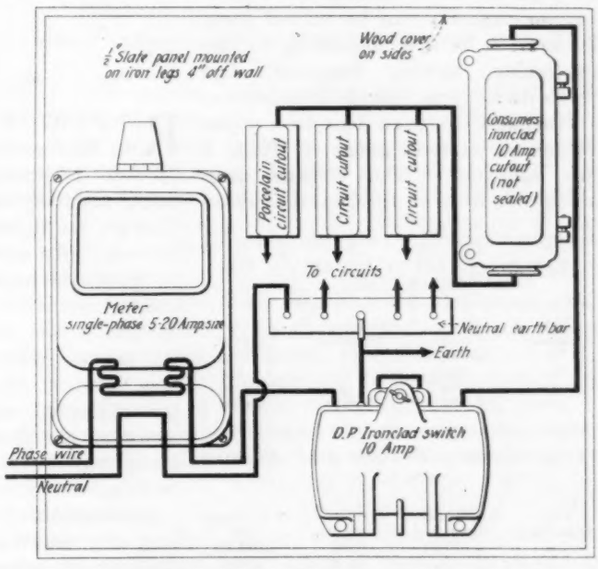
The present Wisconsin State Electrical Code constitutes such a combination of the two national codes, together with such modifications and additions as the State Electrical Advisory Committee found desirable.

JOHN A. HOEVELER,
Industrial Commission of Wisconsin, Electrical Engineer.
Madison, Wis.

Grounding the Neutral

To the Editor of the ELECTRICAL WORLD:

I have just received your issue of January 17, and I find the letter of R. A. Williams of Tientsin, China, very interesting. In this country the universal practice also is to earth the neutral wire at every installation. All distribution of power on new installations is on the three-phase, four-wire system, operated at 400 volts for motors and 230 for lighting, etc. In fact, under the government regulations any other voltage is virtually barred, which is a good thing for the country. Old installations are changing to this distribution and voltage. We have not yet gone as far as Mr. Williams in making the neutral wire in the houses bare, but I expect and hope that this will come. All wiring in houses and other buildings is done in screwed steel conduit. Wood casing and knob wiring are obsolete and vetoed.



WIRING DIAGRAM OF HOUSE SERVICE BOARD UNIVERSALLY USED IN NEW ZEALAND

I inclose herewith a plan of meter-board wiring which shows the method used by us, which is practically standard practice in New Zealand. The phase wire to consumers' services is further protected by means of a pole fuse where the service is tapped to line.

W. A. WATERS,
Manawatu-Oroua Electric Power Board, Chief Engineer.
Palmerston North, New Zealand.

Central Station and Industrial Practice

Thawing Out Frozen Water Pipes

BY HARRY J. ACHEE
Chief City Electrician, City of Woodward, Oklahoma

DURING the past winter this city experienced serious trouble with service water pipes freezing. A few mains also froze up. To overcome this trouble apparatus, as shown in the accompanying illustration, was built. The distribution service of the town is 2,300 volts. By means of transformers this was stepped down to 110 volts or 55 volts according to the length of pipe to be thawed. With 110 volts fairly long lengths of pipe can be thawed, but for hydrants and short stretches of pipe 55 volts is ample. Transformer capacity can be varied from 30 kva. to 50 kva. according to the particular service required. The whole thing was placed on a trailer.

Normally to thaw cast-iron pipes values of current given in Table I are sufficient. The voltage drop along pipe lines of different diameters where joints are well made and electrical contact is good is given in Table II.

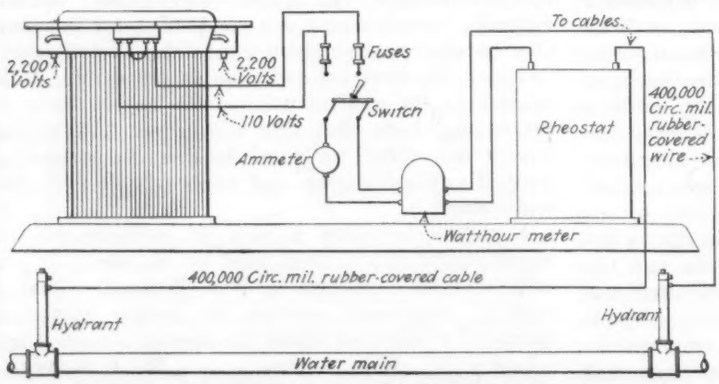
TABLE I—CURRENT NECESSARY TO THAW PIPES

Pipe Diameter, In.	Current, Amp.	Pipe Diameter, In.	Current, Amp.
3	280	8	800
4	390	10	1,200
6	600	12	1,400

TABLE II—VOLTAGE DROP IN CAST-IRON PIPE

Pipe Diameter, In.	Voltage Drop per 1,000 Ft.	Current, Amp.	Resistance per 1,000 Ft.
4	1	14.8	0.068
6	1	22.8	0.044
8	1	33.3	0.030
10	1	45.5	0.022
12	1	59.4	0.017

Much of the work done was on fire hydrants and short lengths of mains, which varied from 2 in. to 10 in. in diameter. For small service mains to residences in the section of the city where the only voltage available was 110 or 220 a small portable transformer was used which reduced this voltage to 12 volts. The primary winding of this transformer consists of 530 turns of No. 11 magnet wire divided into two windings of 265 turns each, connected in parallel for 110 volts and in series for 220 volts. The secondary is made up of forty turns of No. 2/0 enamel wire. The complete transformer was placed in a wooden box 12 in. x 18 in. x 22 in. and weighs about 65 lb. The primary terminals are brought out on top and connected to a knife-fused switch. The voltage of the secondary is 12 volts and 180 amp. can be drawn without overloading the transformer. With this transformer 1-in. pipe or smaller can be thawed.



ARRANGEMENT OF APPARATUS FOR THAWING FROZEN WATER PIPES

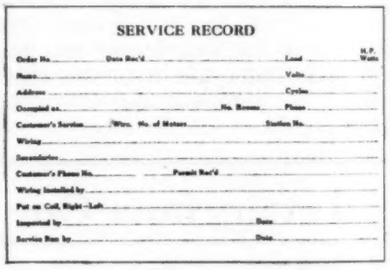
Running Customer's Service

Method Employed by Kansas City Power & Light Company for Handling Work Outlined—How Work of Distribution Gangs Is Compared

BY J. G. PICKETT, JR.
Service Department, Kansas City Power & Light Company, Kansas City, Mo.

RUNNING of customers' services in Kansas City, Mo., is handled by four two-men gangs, each gang being normally confined to a definite district to minimize the traveling between jobs and to enable the men to become intimately acquainted with their respective districts and the nature of the work required there. Of course, when the demands for new services in any district exceed the physical capacity of the gang assigned to that district, another gang may be sent into the district to help.

Instructions to install new services are received from the contract department in order form and transferred by a typist to "service record" cards in duplicate, like the one shown, the original being typed in


SERVICE RECORD

Order No. ____ Date Rec'd ____ Load ____ H.P. Watts
Name ____ Volts
Address ____ Cycles
Occupied as ____ No. Rooms ____ Phone
Customer's Service ____ Wire No. of Meters ____ Station No.
Wiring ____
Secondaries ____
Customer's Phone No. ____ Permit Rec'd
Wiring Installed by ____
Fat on Coil, Right—Left ____
Inspected by ____ Date
Service Run by ____ Date

FIG. 1—SERVICE ORDER RECORD

black and the duplicate in red. If the city inspector's permit has been received, the contract department notifies the service department and the "service record" cards are stamped "Permit in office." The red copy is filed by street number (to avoid confusion regarding names) in a file on the service clerk's desk. The company's service inspector is then required to investigate the customer's installation, since it has been found that some installations passed by the city inspector are not acceptable to the company. Notation of the time the order is given to the inspector is made on the red office copy. If the installation is not satisfactory, the inspector so reports to the service department, which informs the customer directly or through the contract department. When the installation has been passed by the company's inspector,

the service department is notified by telephone, or, if it is too late to dispatch the order to the service foreman, the inspector rings in his report personally, at which time he signs the service record (black copy). From his reports a list of meter releases is made out in duplicate and one copy sent to the contract department.

Normally the black "service-record" card filled in by the inspector constitutes the order for the service foreman to install the service. These cards are put in heavy manila envelopes for the foreman who will handle the work and placed on the service truck at night. Where this procedure would involve an undesirable delay, the instructions are given orally over telephone and the foreman is required to fill in the card the following day. Record of the time at which the order is given to the service gang is made on the office copy. The service foreman is required to call the service department after completing each service to report on the job and take further instructions.

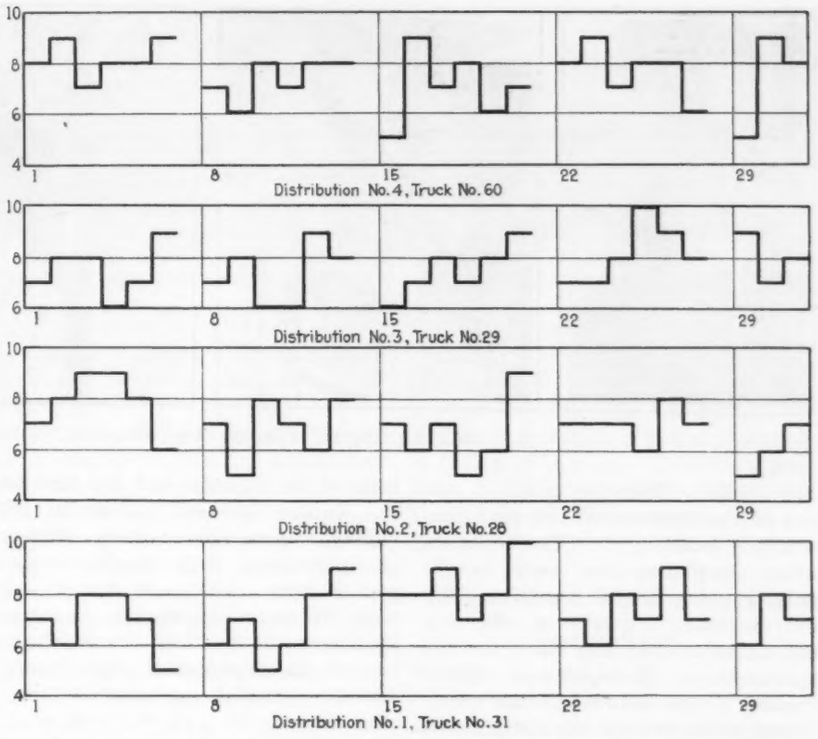


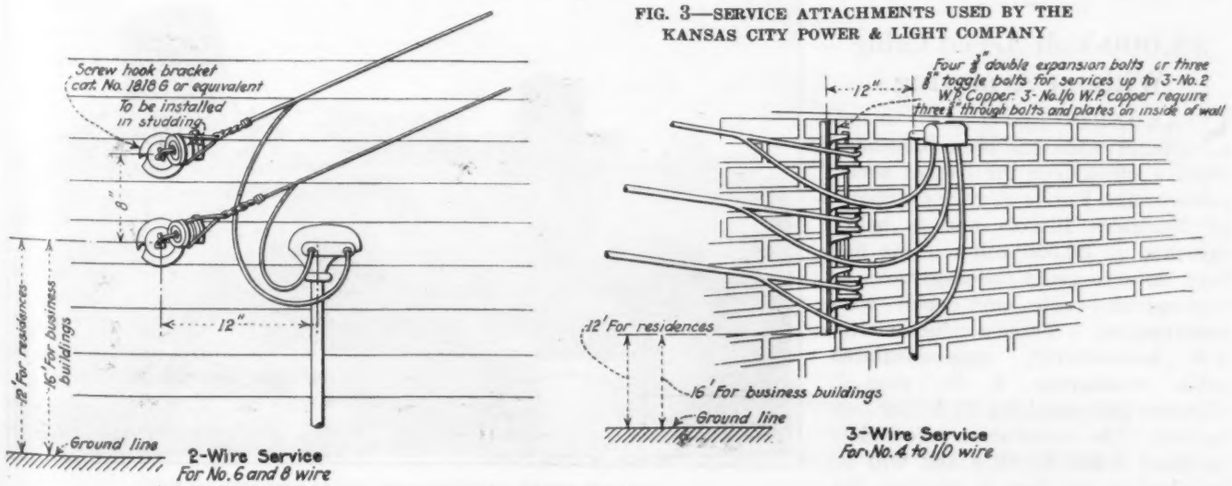
FIG. 2—FORMS IN WHICH PERFORMANCES OF SERVICE GANGS ARE COMPARED

When the service-record card filled in by the service foreman completing the work is received by the service clerk, he routes it through the transformer record and contract departments for completing their records. Upon its return with visés by these departments the black copy with all signatures is placed in a permanent file classified by street number. A curve of work performed by each gang per day is given to each service foreman monthly. A sample is shown. Monthly and yearly recapitulations of all services run are made for office reference.

The two-man gangs consist of one lineman and a meterman, the lineman acting as foreman. Operations of one of the two-man gangs are illustrated herewith. Upon arriving on the job the foreman ascertains whether it is the proper location and what materials are required to run service. He then returns to the truck and, helped by the meterman, carries the necessary tools and material onto the job. The subsequent work that is entailed is conducted as follows:

The meterman installs brackets on the building above the service outlet. The foreman lights the solder pot. The meterman watches the coil of wire while the foreman strings it out to nearest service pole. The meterman dead-ends the service on the building and connects it to outlet. The foreman climbs the pole, pulls up the service and dead-ends it. Then he proceeds to test or "lamp out" the service so that he will not connect the house ground to either of the "hot" wires on secondaries. In other words, he makes certain that he connects the house ground onto the neutral wire of the secondaries. He also makes a test on secondaries to be sure that there is not a foreign ground on them. At the same time he determines whether there is a system ground on these particular secondaries. While he is doing this, the meterman installs the meter, checks the number of rooms and tests all circuits to see if they

FIG. 3—SERVICE ATTACHMENTS USED BY THE KANSAS CITY POWER & LIGHT COMPANY


Screw hook bracket cat. No. 1816 G or equivalent
To be installed in studding
8"
12"
12' For residences
16' For business buildings
Ground line
2-Wire Service
For No. 6 and 8 wire
Four ⅜" double expansion bolts or three ⅜" toggle bolts for services up to 3-No. 2 W.P. Copper. 3-No. 1/0 W.P. copper require three ⅝" through bolts and plates on inside of wall
12"
12' For residences
16' For business buildings
Ground line
3-Wire Service
For No. 4 to 1/0 wire

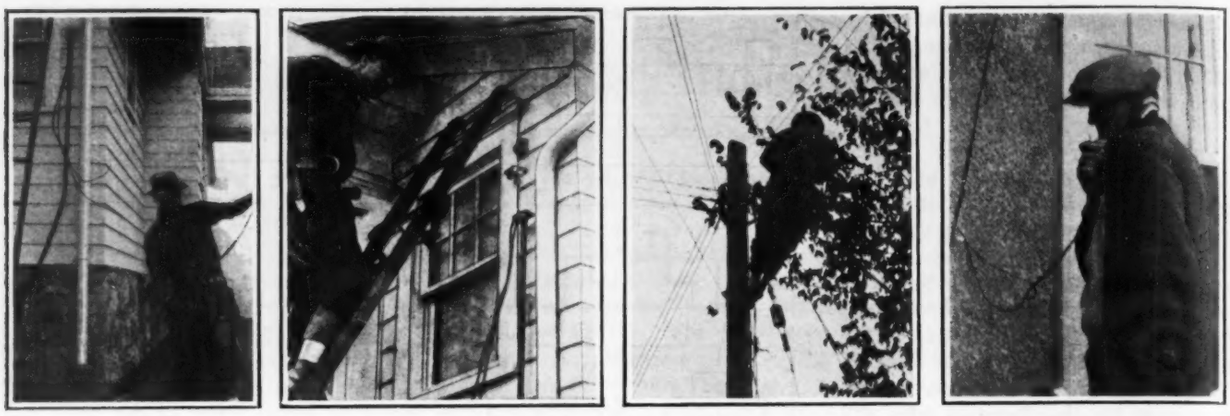


FIG. 4—STEPS IN OPERATIONS OF TWO-MAN SERVICE GANG

are "O.K." Then he makes a record of the meter installed, including number, location, etc. The foreman, after completing his work on the pole, returns to the truck, making out necessary requisitions, charging out material used and filling out the service card. Material used during the day is replaced on an order requisition made out by the foreman at the completion of a day's work. At the same time he makes out his daily report and time ticket and turns it in to the proper department.

Service gangs report at the company garage to start their day's work and quit on job. The meterman returns the truck to the storeroom and the unused meters to the meter department. The trucks used are standard screen-side Dodge commercial trucks with special bins for material and a padded compartment for transporting meters. The screens are not used, this space being used for tool compartments and ladder racks.

In running domestic services No. 8 wire is used for bungalows and cottages, No. 6 wire for larger houses and No. 4 wire for range services.

33,000-Volt Aërial Cable Without Armoring

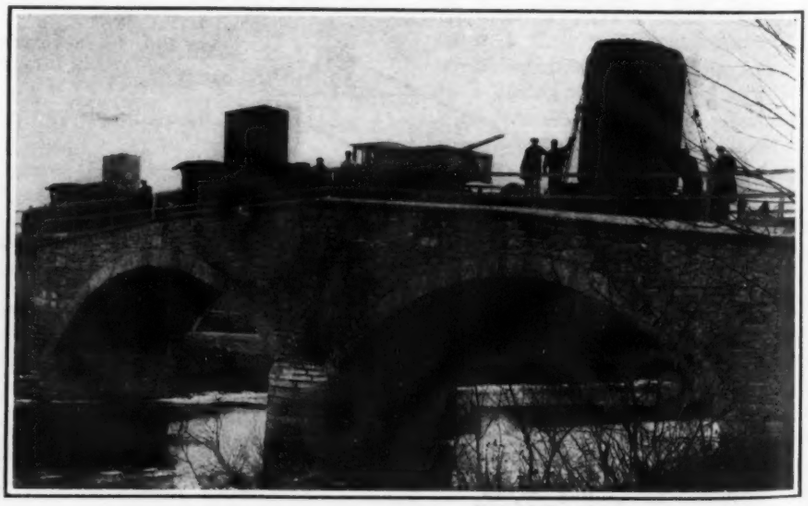
STANDARD lead-covered underground cable has been suspended from a messenger for use as aërial cable by the Public Service Company of Northern Illinois and is being operated at 33,000 volts. This has been done to avoid the objections to underground-cable and open-wire construction. Three-conductor No. 4/0 lead-covered, paper-insulated cable measuring 3 in. over-all diameter and weighing 11 lb. per foot is used. The installation referred to is about 3,000 ft. long and will be watched to see how it survives the heat of the summer and the cold of the winter as well as accidental damage from rifle bullets, stones, etc. However, little trouble is expected from intentional damage as boys formerly indulging in mischievous destruction have been taught to understand the inconvenience, trouble and expense they may cause.

At the extreme ends of the cable are joints that convert the three-conductor cable into three single-conductor cables. These in turn terminate in single-conductor, 45,000-volt potheads which join with open-wire lines. Disconnecting switches have been installed so that the load may be transferred from this aërial cable to open-wire lines.

Transporting Heavy Transformers Over Country Roads

BY J. WALTER MAY
General Superintendent of Construction Day & Zimmermann, Inc., Engineers

THE construction of the Roxbury transmission line connecting the Saxton plant of the Penn Central Light & Power Company with the Potomac Public Service Company's system necessitated the construction of an outdoor substation at Roxbury, near Shippensburg, Franklin County, Pa., with three single-phase 3,333-kva. transformers. The substation site being situated a distance of 8¾ miles from the nearest railroad made the problem of moving the transformers one of the outstanding features of construction. The problem became more interesting when it was found, after a careful survey of all roads and conditions had been made, that all the hauling had to be done over narrow dirt country roads, with steep grades and sharp turns at frequent intervals. It was also found necessary to "overbuild" an old two-arch stone bridge which was erected in the latter part of the year 1700, the arch rings of



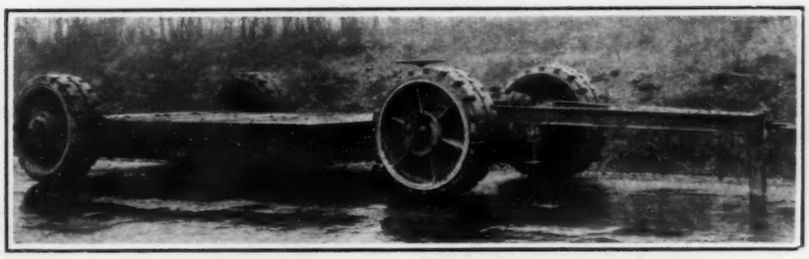
TRANSFORMER PASSING OVER RECONSTRUCTED BRIDGE

which were in such poor condition that it was impossible to predetermine their safe carrying capacity.

The "overbuilding" of this bridge consisted, principally, in constructing a new timber roadway deck consisting of 3-in. oak planks over the old roadway. This deck was supported on long Bethlehem section steel beams, placed on each side of the bridge in groups of three in a position under the deck to receive the wheel loads of the transformer truck advantageously. These beams were supported at each end of the bridge, and in the center between the arch rings, on cribbings built of railroad ties which transmitted the loads to the original bridge abutment piers and the arch pier in the center respectively. These were found to be in substantial condition. The old bridge deck was of "camelback" design, making it necessary to raise the new deck at the approaches to provide clearance between the bottom of the steel beams and the top of the old stone bridge arches, so that deflection in the beams would not impose loads on the arches. Timber cribbing was placed at the approaches to provide for a gradual slope in the timber decking adjoining the bridge proper.

The transformers were shipped filled with oil, each weighing 28 tons. They were loaded in "well" type cars by prearrangement with the manufacturer.

A specially built transformer truck trailer was provided for the job. This truck, weighing 7½ tons, was equipped with a heavy underslung frame of structural steel and was designed for a carrying capacity of 30 tons. The trailer was equipped with heavy-duty type roller-bearing wheels with 40-in. x 14-in. solid-rubber tires. Brakes were provided on the rear wheels with brake drums, of 31-in. diameter and 6-in. face, and were controlled by a ratchet wheel on the front of the platform.



SPECIAL HEAVY-DUTY TRAILER FOR CARRYING 28-TON TRANSFORMERS

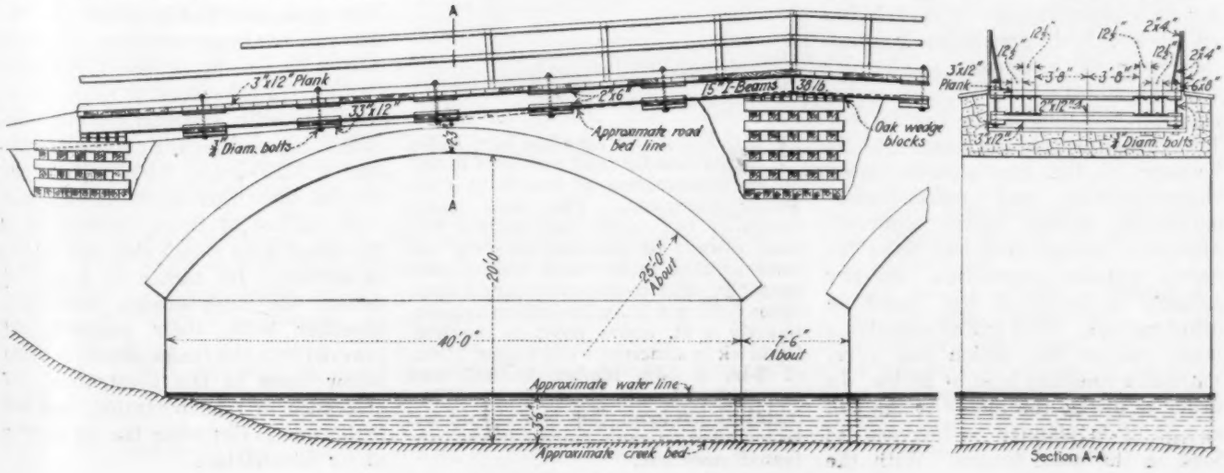
The transformers were unloaded from the cars with a heavy-duty railroad-type wrecking crane—the first two transformers being placed on cribbage provided alongside the roadway and the third loaded directly on the trailer. The total load of transformers and truck amounted to 35½ tons, for which three 5-ton automobile trucks were provided for transportation. Under favorable conditions the trailer was moved at the rate of 3 miles per hour. The average speed was lowered considerably, however, by the heavy grades which were encountered, where it was found that the three trucks were unable to draw the load. At these points heavy tackle was brought into use. The first truck was sent forward several hundred feet and placed against the bank, crosswise of the road, and used as a "deadman" for the tackle; the second truck was used to pull ahead on the free end of the tackle, while the third was coupled to the transformer trailer to aid in pulling direct and controlling the tongue of the trailer. This method was repeated until the crest of the hill was crossed. Grades of 14 per cent were negotiated in this way without event.

A total haul of 25 miles was involved, for which painstaking precaution was taken to provide against accident to workmen and public, as well as to eliminate physical damages to the transformers. This work was done by the construction organization of Day & Zimmermann, Inc.

Benefits of Power-Factor Correction

THE experiences of two manufacturing companies using Fynn-Weichsel motors that it was impossible, because of space limitations, to incorporate in an article on this subject in the ELECTRICAL WORLD for February 14, page 345, are given below.

Because of the constant speed maintained by a 10-hp. Fynn-Weichsel motor, breakage of the fine wires used in fifty wire-screen weaving looms has been prevented by the Ludlow-Saylor Wire Company in its St. Louis plant, with an estimated increase in production of 10 per cent. From the time this motor (rated at 900 r.p.m., 440 volts) was installed, in March, 1924, this company has not experienced any interruptions of service nor expended any money for motor repairs. Since this motor represents only one-sixtieth of the total motor load (600 hp.), very little power-factor correction could be



METHOD OF OVERBUILDING WEAKENED BRIDGE

noted, although some correction is present.

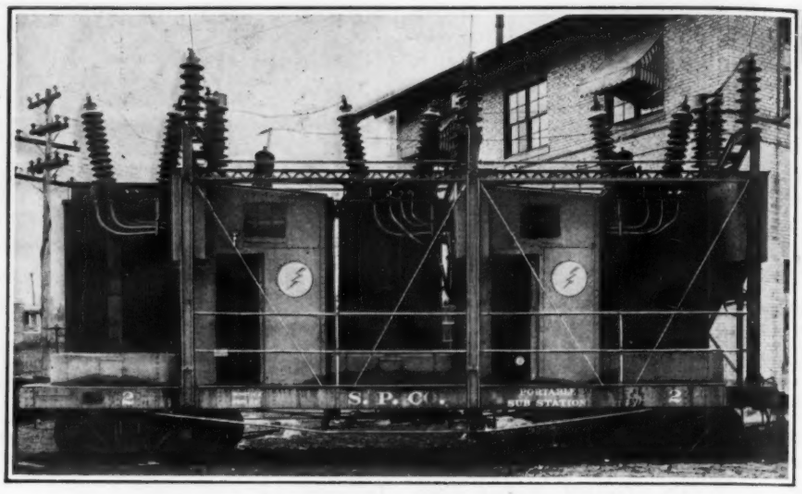
Guilford Duncan, president of the company, has commented upon the motor's performance, as follows:

"We have had superior performance of our wire looms because of the high starting torque and the constant speed of the motor. This is a very important factor with looms handling fine wire such as is used in manufacturing fly-screen cloth. As the fifty looms operated by this motor handle different widths of fly-screen cloth, it is hard to determine, in square feet, what the increased production due to the use of this motor amounts to. However, I feel that, on a conservative basis, the production has increased fully 10 per cent as a result of the constant speed of this newly installed motor."

The plant of the International Shoe Company at St. Louis affords an interesting example of an industrial installation not subjected to power-factor penalty clauses in its energy rates, but still interested in power-factor correction as it may affect the speed characteristics of motors and thereby the production schedule, which is highly important. Though there are no inducements from the utility company in the form of power-factor penalty or bonus clauses, the company serving the shoe company did urge the improvement of power-factor because of the long feeder and the consequent voltage regulation. The company is considering various means of improving plant operating results, including Fynn-Weichsel motors and static condensers, being interested in trying out methods of power-factor correction that can be applied at other plants where energy is purchased under power-factor clauses.

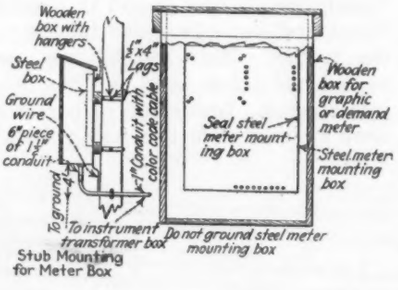
Without any power-factor-correction equipment, the power demand for this plant ranges from 45½ kw. to 60 kw. with power-factor ranging from 70 per cent to 76 per cent. A 40-hp. Fynn-Weichsel motor has been installed in the box factory for experimental purposes, chiefly because of the synchronous speed characteristics and power-factor-correction effects, which eliminate abnormal voltage drop and make for better voltage regulation, thereby helping to maintain the speed on other motors. This motor operates a large suction fan which has a remarkably constant load of 26 kw. In order to utilize the motor to the full extent, it is planned to increase its load in the near future. With the motor adjusted to give 90 per cent leading power-factor continuously, the effect on the demand and power-factor of the plant is as follows: 72 kw., 92 per cent power-factor; 84 kw., 92 per cent; 72 kw., 93 per cent; 86 kw., 96 per cent; 77 kw., 94 per cent. With the power-factor-correction motor disconnected, the demand and power-factor of the plant are the same as previously stated.

According to Mr. Hume, chief engineer of the company, the power-factor-correction motor is operating with complete satisfaction. In fact, an order has been placed for another motor of the same type but of larger size.



PORTABLE SUBSTATION USED BY SOUTHERN POWER COMPANY

Graphic or Demand Meter Box


Wooden box with hangers
Steel box
Ground wire
6" piece of 1½ conduit
ground
To instrument transformer box
Stub Mounting for Meter Box
1" x 4" Lags
1" Conduit with color code cable
Seal steel meter mounting box
Wooden box for graphic or demand meter
Steel meter mounting box
Do not ground steel meter mounting box

THE box shown here has been added to the standards of overhead distribution construction of the West Penn Power Company. The steel meter mounting box inside the wooden box shall always be mounted securely and level so that meter clock will operate properly. For indoor mounting a clear space 3 ft. x 4 ft., with bottom approximately 4 ft. above floor, is required. On brick or concrete walls fasten pieces of 2-in. x 4-in. lumber to wall and mount steel box on these pieces. When installed outdoors this box should not be mounted on same pole as instrument transformer box.

Portable Substation for Emergency Service

THE Southern Power Company has in service three portable substations on railroad cars suitable for operation on primary voltages of from 10,000 to 100,000 volts, each car carrying three single-phase transformers having a capacity of 1,000 kva. In addition it has one flat car mounted with switching and metering equipment, on which can be placed within a very short time transformers of any other rating. One of these substations is kept at each extreme of the company's system and one in the region of the greatest load, and they have proved invaluable in servicing customers in time of trouble as well as supplying temporary power during construction.

Primary voltages may be had at 92,000, 88,000, 84,000, 80,000, 76,000, 72,000, 44,000, 40,000, 38,000, 36,000, 11,333 and 10,000 volts, secondary voltages at 2,560, 2,380, 1,980, 1,800, 600, and 550 volts; a 300-kva. winding supplies power at 120/240 volts.

Each car carries the transformers, three-pole, electrically operated, 100,000-volt air-brake switches, a blower driven by a 20-hp., 110-volt motor for cooling transformers, a switchboard complete with ammeters, voltmeters, indicating and recording wattmeters, and a 3,000-amp., 7,500-volt, three-pole oil switch on the secondary side.

A feature of these substations is the speed with which they can be put in service. By means of a ratchet device the high-tension insulators, together with their support, are lowered into the tanks, shown directly below them in the illustration, for clearance in transportation, and but little time is lost when the car arrives at its destination.

Commercial Activities and Public Relations

Electric Refrigerator Sales Methods

BEFORE a record-breaking attendance of the Appliance Bureau of the Commercial Section, New England Division, N. E. L. A., at Boston on April 6, W. J. Debbler, sales manager Edward L. Pearson Electric Company, Brockton, Mass., outlined the following methods of selling domestic electric refrigerating equipment: (1) By advertising in newspapers regularly and consistently; (2) by repeated demonstrations on sales floors, at electric shows, fairs, in windows and in residences; (3) by direct-mail campaigns followed up by calls from trained and specialized salesmen.

The speaker said that last year's business in southeastern Massachusetts was about one-third of the volume handled thus far in 1925 for the same period. Remarkable success has resulted from the trial installation of domestic refrigerating outfits in cases where prospective buyers have been hesitant, few if any machines having been removed after even temporary installation. Much success has also resulted from the mailing of finely illustrated leather-bound "loaned" books on electric refrigeration to home managers, these being collected and accounted for later by field salesmen after the interest of the "prospect" has been aroused. Good service, the speaker said, is the keynote of successful sales development.

Customer-Owners Number 15,000 in Oklahoma

FIGURES on the extent to which the customers of public utility companies have become stockholders were quoted recently by J. F. Owens of Oklahoma City, vice-president and general manager Oklahoma Gas & Electric Company. He said that there are 15,000 Oklahoma stockholders in the utilities actually serving Oklahoma. These 15,000 stockholders have invested upward of $15,000,000 in the public utilities of this state. "I want that to sink home," said Mr. Owens—"fifteen millions of dollars that ordinarily would have found its way through the regular channels of investment back through the Eastern money markets and perhaps have been placed in some of the public utilities in the form of bond ownership. Last year there was paid out in Oklahoma in dividends on the stocks owned by the public in public utilities more than a million dollars that under the former operation, prior to 1917, would have found its way back into the Eastern money markets and would have gone into the channels of trade there, but that money enters into circulation in this state.

"Our own organization has more than five thousand stockholder customers in Oklahoma, all, with a very few exceptions, users of our service. Customer ownership is no longer a theory; it is no longer an experiment; it is an established fact, and the time is coming when virtually all of the stock in public utility companies will be owned by the men and women who use its service."

Sales Campaigns Build Load and Good Will

Connected Lighting Load Increased 600 Kw. and $60,000 Annual Revenue Added with no Capital Outlay by Sale of Commercial and Domestic Units

BY A. C. CRANDALL
Sales Manager Central Indiana Power Company Subsidiaries, Indianapolis, Ind.

THREE campaigns which were conducted by the Central Indiana Power Company subsidiaries during the past year have done much to build load, create good will and bring profit to the companies. The campaigns demonstrated that so-called "high-pressure" methods are not essential in central-station merchandising. More than 600 kw. was added to the connected lighting loads of these companies. The estimated additional revenue from this new load amounts to $60,000 per year. A kitchen-unit campaign resulted in sales to 26 per cent of the residence customers. No capital outlay was required to connect this load to the distribution system. That such campaigns as these can be conducted at a profit is evidenced by the fact that the budgets of expenditure were not exceeded and each campaign resulted in a net profit of from 5 to 10 per cent.

TRUCK CARRYING STOCK OF UNITS IN PORTABLE LAMP CAMPAIGN AT HUNTINGTON, IND.

Good will is largely a matter of confidence and appreciation. That merchandise campaigns can build good will may be shown by an incident arising from these three campaigns. One of the company's salesmen in Kokomo was making a first

call to ask for a trial installation of the portable lamp. He found the man of the house at home. The salesman introduced himself as representing the Northern Indiana Power Company and asked permission to show a new idea in lighting for the home. The "prospect" asked the price and terms, and when these had been given he said: "I will take the lamp. You need not bother with the trial installation. Some months ago your company sold my wife a new lighting unit for the kitchen. This lamp has proved more than satisfactory and my family is much pleased with the service the lamp is giving. About a month ago your company made a survey of my store and put in a trial installation of a new lighting fixture. This installation has increased my business and has done all that you said it would do. I am sure that if you recommend this new portable lamp it will be worth all that you ask for it. You may bill me for the lamp in the usual way."

INTERIOR OF KOKOMO SALESROOM DURING A COMMERCIAL LIGHTING CAMPAIGN

PLAN OF CAMPAIGNS

An outline of these campaigns, the policies and methods followed, illustrate the possibilities for a central-station company to build load, create good will and make a merchandising profit from its sales operations.

Four subsidiaries of the Central Indiana Power Company merchandised electrical appliances in these campaigns — the Merchants' Heat & Light Company of Indianapolis, the Northern Indiana Power Company of Kokomo and surrounding territory, the Wabash Valley Electric Company of Clinton and adjacent communities, and the Attica Electric Company of Attica and nearby towns. The communities covered by the campaigns represent a fair cross-section of Indiana, ranging from the coal-mine sections of the southwestern counties, through the stone-quarry district around Greencastle, the metropolitan district of Indianapolis and into the combined agricultural and industrial area surrounding Kokomo. At the time these campaigns were conducted there was little employment in the coal-mine areas or in the industries of Kokomo. In the other districts conditions averaged about normal.

Three principles dominated: First, to build load and extend central-station service; second, to build good will through rendering service as well as selling appliances; third, to make a definite merchandise profit even though the percentage were small. Each of these campaigns was built around a special lighting unit which was emphasized as an example of merchandise which does an old job in a better way. Various modifications of the campaigns were adopted to suit conditions in different communities, but the general policies and plans behind the campaigns were the same throughout all the companies.

Good will was cultivated by demonstrating to the customer that the central-station company was ready to render a service and not satisfied merely to sell him an appliance. To convey this idea great care was exercised in selecting lighting units which would actually render the customer an obvious service in illumination, comfort and utility far greater than the price of the unit. These units were sold on the basis of what they would do for the customer rather than their value as a mere combination of light bulb, glassware and metal hanger.

As an assurance of merchandise profit there seems to be no substitute for thorough preliminary planning. It must include the selection of the particular merchandise to campaign, the selection of "prospects," the selection of salesmen, the determination of sales quotas, period of activity basis of compensation and all items of sales expense.

Campaigns were built around three lighting units — (1) the kitchen lighting unit, (2) the commercial lighting unit, (3) a portable lighting unit for the home.

While the method of handling the merchandise, terms of sale and basis of compensation differed in all campaigns, the general outline was the same. Before each campaign a prospectus was prepared and placed in the hands of all persons engaged in the activity. In this prospectus every feature of the campaign was covered in detail, as shown in the following, which virtually constitutes a sales manual:

PROSPECTUS FOR PORTABLE LAMP CAMPAIGN

Introduction.—A statement of the general problem of the campaign, such as the need on the part of the customer of the service to be rendered by the particular appliance being sold.

The Unit.—A detailed description of the unit to be campaigned, together with the sale price and terms.

Selling Plan.—A complete outline of the various steps to be taken by the salesmen in carrying on the campaign. District quotas were specified as a certain percentage of lighting meters in the class to which the particular appliance to be sold belonged. In the kitchen-lighting campaign the quota was established as 15 per cent of the residence-lighting meters. In the portable-lamp campaign the quota was set at 6 per cent of the residence-lighting meters. Specimens of all record forms, form letters and mailing pieces to be used during the activity were included in the prospectus.

Compensation.—Commissions, bonuses and prizes were established on a liberal basis; prizes for exceeding the quotas were also very liberal. The sales expense was based on reaching the quota. However, a considerable amount of money was made available for distribution as special prizes for high individual sales and high district sales in case the quota was exceeded. Under this schedule some regular salesmen earned more than $400 during one month of the campaign.

Organization. — In all campaigns only the regular salesmen of each district were used. On the first campaigns these men were consolidated in one town during the first week to give them the benefit of an intensive training under the direct supervision of the general sales organization. After one week of this training the men returned home and started their own district campaigns. In some of the districts the local manager acted as salesman with exceptionally good results.

Advertising.—An advertising allowance of so much per unit was made, on the basis of reaching the quota.

Accounting and Stock.—Instructions were given on handling the accounting of commissions, invoices and expense items of every nature. Instructions were given on proper control of stock to insure having sufficient merchandise on hand or in transit to cover sales at all times during the campaign.

Budget of Expense.—This was an important feature, both as an aid in planning the campaign and in keeping expenses within established limits and to insure a final net profit. The following items were included in every budget:

Cost of appliance f.o.b. factory.
Freight to destination.
Cost of lamp bulb and attachments.
Stock carrying charge and accounting.
Delivery expense.
Traveling expense.
Advertising allowance per unit.
Salesman's commission.
New-business manager's commission.
Salesman's bonus for reaching quota.
New-business manager's bonus for quota.
(Note: Money for prizes came from savings in certain of above items after quota was reached.)
Total sales expense per unit.
Net profit per unit.

In establishing the campaign budget a definite net profit was always included. This budget, by calling attention of managers to all items of expense, made possible the control of all such items and insured a net profit if the sales quota was reached.

Selling Points.—Very early in the campaigns it became evident that the problem was one of introducing new ideas in lighting rather than selling new appliances or lighting units. For this reason it was found advisable to give the salesmen specific instructions on the method of presenting the proposal. In the commercial lighting campaign it was considered worth while to include a series of questions that prospective purchasers might raise, together with effective answers.

After the prospectus had been issued a meeting of all salesmen and district managers was held in the general office. At this meeting all points of the campaign were discussed. This meeting also afforded an opportunity to utilize the manufacturer's or jobber's experience elsewhere. The enthusiasm aroused by these general meetings did much to start the campaign off with a rush and insure its final success.

Utility Pays 11 Cents Taxes from Each Dollar Received

MORE than eleven cents out of each dollar received from its customers was paid out in taxes in 1924 by the Commonwealth Edison Company of Chicago, indicating the big part this public utility plays in providing funds for the upkeep of the city. Samuel Insull in his address to the stockholders of the company at their annual meeting put particular emphasis on this point, saying:

"A good many citizens are given to abusing the public utilities and criticising them for failing in their duty to the community. If more of the gentlemen who do that kind of criticising would pay their fair percentage of the taxes of the community, and that fair percentage would be on a basis of the taxes that the public utilities pay themselves, our tax rates would be lower. The burden would be more evenly distributed and the agitator would be paying his way in the support of the community in the same way that the institution he criticises is paying its way.

"We paid out in 1924 a total of $5,982,090 in taxes. That is, for every dollar bill we received from our customers for electricity we had to pay 11 cents to the municipality, the state or the nation in one form or another for taxes and municipal compensation. In other words, from every dollar we received from our 750,000 customers we returned 11 cents for the general upkeep of the community, the state or the nation."

More Electric Trucks for Chicago

THE American Railway Express Company, already the largest user of electric trucks in America, has added twenty "electrics" to its Chicago fleet, bringing its Chicago electric trucks to a total of 140. This latest addition to the Chicago fleet replaces horses. The congestion caused by the slow moving of horse-drawn vehicles in metropolitan areas is causing more attention to be given to the superiority of "electrics" for the transfer of merchandise in congested districts.

Twenty-five Hundred Visit Electric Home in Week

APPROXIMATELY twenty-five hundred people in Canton, Ill., have visited a model electric home in one week in response to four thousand invitations sent out by the Central Illinois Public Service Company. This model electric home was sponsored by the public service company and was made possible by the co-operation of Canton business men who assisted with furnishings and decorations for the exhibition. Important aid was given by the Canton contractors, all of whom were very much interested in this home.

Every phase of scientific lighting is employed to obtain the correct illumination. Eye strain and glare are avoided by the careful arrangement of the lights as well as by the studied system of proper types of fixtures. Attractive color combinations are effected by the well-planned interior decorations. Especially appealing to the women is the kitchen with electric dishwasher, electric percolator and electric refrigerator.

A feature of the entire equipment is a master switch in one of the bedrooms by which every light in the house, including the basement and porch, can be lighted as a protection against burglars.

EFFECTIVE FLOODLIGHTING OF CANTON (ILL.) ELECTRICAL HOME

All closets are equipped with automatic switches, which turn on a light as the door opens, turning it out when closed. Three-point switches in all of the rooms permit operating the lights from either side of the room.

Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

New Style Windmill for Electric Plants.—H. NOTTELMANN.—The rapid development of aërodynamics, brought about by airplane practice, has been responsible for a radically different wind turbine recently designed and built. The main characteristic of the windmill is a four-vane propeller, similar to the airplane type. The first of these mills has been erected on a tall, slender tower constructed of reinforced concrete and gives with a wheel of only 19 sq.m. surface an average output of 10 kw. A yearly output of 30,000 kw.-hr. is expected. The plant will operate with wind velocities as low as 2 m. per second. Two generators of 2 kw. and 600 watts are being developed now along the same lines. A specially designed direct-current dynamo, different from the customary counter-compound type, has been developed which prevents an overcharge of the battery and which is capable of delivering current directly into the line after having completed the battery charge. Between 750 r.p.m. and 2,000 r.p.m. this generator gives practically constant voltage. A switchboard with four relays makes the entire plant fully automatic. —*Elektrotechnische Zeitschrift,* March 12, 1925.

Air Preheaters.—C. W. E. CLARKE.—The idea of preheating air for combustion is traced historically from the time of its introduction in the iron-smelting industry in 1829. Methods now in use are described and illustrated. A double-page tabulation gives exhaustive data on preheater installations in operation and on installations in course of erection or on order. — *Mechanical Engineering,* March, 1925.

Transmission, Substations and Distribution

French Rural Electrification. — H. AMBROSE CARNEY.—This installment of a continued article discusses tariffs and load densities. A statistical table gives population, number of consumers, average kilowatt-hour per year separately for light and for power, and price per kilowatt-hour for fifteen agricultural districts. The rates are notably low, in but one case exceeding 2 fr. and in a number of instances being as low as 1.13 fr.; the depreciated value of the monetary unit must be considered in making comparisons with rates in other countries. These figures are for lighting: the power rates are lower.—*Electrician (England),* March 20, 1925.

Calculation of Induction from Power Lines to Telephone Lines.—G. EGGELING. — The knowledge of the voltage induced in telephone lines by three-phase power lines on the same towers is necessary for the proper design of insulators, apparatus and protective devices on the latter. The author gives the method of mathematical calculation of the electric and magnetic fields for permanent ground and double ground, which leads to induced voltages of more than 30 per cent of the power voltage. For static induction at single ground a simple and sufficiently accurate approximation method is given, based on very plausible assumptions. Electromagnetic induction is difficult to calculate, but here, too, practical experiences have led to a quite accurate approximation, giving, for double ground, values of about the same magnitude as the static voltages. Elaborate tabulations and curves give many actual measurements made on existing lines, showing in general a close check with calculated values. — *Elektrotechnische Zeitschrift,* March 12, 1925.

Generation, Control, Switching and Protection

Improvement of Power Factor.—MILES WALKER. — The devices that cause lagging current are taken up in order. The transmission line, when heavily loaded, introduces a drop that can be neutralized by synchronous machines, but a more satisfactory and much cheaper way would be to transmit by extra-high-voltage direct current. Conversion at the sending end would seem possible by vacuum valves, but would probably require rotating apparatus for reconversion at the receiving end. The problem of commutation

METHOD OF CONVERTING ALTERNATING CURRENT TO DIRECT CURRENT FOR TRANMISSION

arises. In this connection experiments have been made with a method illustrated in the accompanying illustration. The six coils of a 440-volt alternator were brought out to a six-part commutator, and direct current was fed into it by means of two compound brushes, *PP'* and *NN'*, with mercury-arc rectifiers, *VV*, between the branches and small batteries, *BB'*, to neutralize the back voltage of the rectifiers. The resulting commutation when the machine was operated as a motor was absolutely sparkless. For power-factor correction with the induction motor the use of a phase advancer is held to be far cheaper and more efficient than the induction-type synchronous motor. Several types are compared, with the aid of circle diagrams.—*World Power,* February, 1925.

Transformer Details.—K. THIEN.—The purpose of laminated sheets in transformer cores may be defeated if the edges of the laminations have burrs so that they touch each other and establish an electrically conducting bridge. Rolling or grinding of the punchings must be resorted to unless very high-grade dies are available. Another source of danger is the core bolts pressing the sheets together. Excellent insulation of the shank of the bolt and under the end nuts is essential to prevent iron ground with subsequent breakdown. Oil-cooling canals along the bolts, such as are being made and recommended by German designers, are not at all necessary, because the bolt always stays cooler than the laminations. To insure short-circuit-proof windings a very secure lodging of the disk coils is imperative. By molding non-compressible spacers directly upon these coils this can be readily achieved. The assembly of such disk coils is very simple, and the stack cannot shrink, so that a "follow-up" device, such as springs, is not required.—*Electrotechnik und Maschinenbau,* March 8, 1925.

Units, Measurements and Instruments

Stroboscopic Determination of Speeds and Frequencies.—G. E. MOORE.—After discussing the underlying principles of the stroboscopic method in general, the author describes several methods involving the use either of the "phonic motor," a small machine with a five-toothed armature driven from an alternating-current source or from a battery circuit with tuning-fork interruption, or of a tuning fork fitted with wings for interrupted "slit vision." Such methods are capable of a high degree of precision, the speed range is practically indefinite, instantaneous determinations are possible as with acceleration or retardation tests, no load need be placed on the rotating part, and hunting or cyclic irregularities are observable.—*Engineer (England),* Feb. 20, 1925.

Measurements of Resistance in the Windings of Rotating Machinery and Transformers. — A. BERGGREN. — The author discusses resistance measurements in general, with specific reference to possible errors due to inductive effects.—*Teknisk Tidskrift (Swedish) Elektroteknik,* March 7, 1925.

Magnetic Observations.—D. L. HAZARD.—Serial No. 276 gives the results of observations made at the United States Coast and Geodetic Survey magnetic observatory near Honolulu, Hawaii, in 1921 and 1922. Values of declination, horizontal intensity and vertical intensity for both 1921 and 1922 are given. Serial No. 282 gives the same data for the magnetic observatory at Sitka, Alaska. — *Serials 276 and 282 of the United States Coast and Goedetic Survey.*

Relay Control.—J. TAYLOR and W. STEPHENSON.—When a voltage just below the critical value is impressed upon the terminals of a neon lamp in darkness, the incidence of a beam of radiation causes discharge to start through the lamp. The radiation to bring this "flashing" may be light, gamma-radiation, X-rays, etc. The connections

shown include a source of adjustable voltage (150 volts to 200 volts), an adjustable resistance and the lamp with an adjustable condenser in parallel with it. The use of this scheme as a radiation-actuated relay control is suggested. — *Electrician* (*England*), Feb. 6, 1925.

Illumination

Adequate and Efficient Motor Bus Lighting.—L. C. PORTER and A. C. ROY. —This fifty-page booklet presents the results of a study of more than 100 buses. The inadequacy of the lighting in the average bus, which in only 1.9 per cent of the cases examined was as high as one foot-candle on the reading plane and in nearly 30 per cent fell to 0.10 or lower, was found to be due to poor glassware not usually kept clean, improper location of fixtures, inferior low-candle-power lamps, unsuitable color of walls and ceilings, small, badly joined wiring, causing excessive voltage drop, and inadequate batteries. Because of these defects reading is difficult or impossible, standing passengers cut off the light from those seated, glare hides the advertising signs, and the general gloom discourages patronage. Tests showed that, starting with bare lamps and dark coloring, a change to dome units with white ceilings and light walls increased the illumination 71 per cent, and a change to reflector units 132 per cent. Much larger wire sizes should be used than on 110-volt systems. Data given include stop-watch measurements of time saved by step-lighting (11 per cent in boarding and 15 per cent in alighting), effect of reduced voltage on candle-power of low-voltage lamps, and recommendations regarding location, number and style of lighting units, lamp sockets, circuit arrangements, wire sizes, switches, panels and proper battery capacity.—*Bulletin L. D.* 154, *Lighting Data, Edison Lamp Works.*

Motors and Control

Main-Roll Drives in the United States and Canada.—This is a tabulated list containing 1099 items and showing the horsepower, r.p.m., voltage, cycles, type and size of mill, method of drive, date of purchase, name of plant and location. There is also a classified list which gives the types of installation in each kind of mill. According to the list, there are forty-three motors of 5,000 hp. or over; of the two largest, rated at 8,000 hp., one uses 600 volts direct current, the other 13,200 volts alternating current.—*Iron and Steel Engineer*, January, 1925.

Predetermination of the Performance of Induction Motors.—D. B. HOSEASON.—Ordinarily, for lack of time to take into account all factors, the designer has to be satisfied with approximations in his predetermination. The paper describes a method for overcoming this difficulty. A group of accurate formulas is developed on the basis outlined by Steinmetz and is given alongside the approximate formulas that have hitherto been much used on account of their simplicity. Curves are then drawn showing the difference between the two results, and factors are found that can be applied as corrections to the results by the simpler methods.—*Journal of the Institution of Electrical Engineers* (*England*), March, 1925.

Spinning and Weaving Mills.—H. FUHRKEN.—This illustrated article describes modern practice with electric drive in Germany. In general the squirrel-cage motor is preferable because of its constancy of speed, totally inclosed air-jacketed motors being used where there is much dust or cotton waste. On the ring spinning machines a gain in output can be obtained by using two-speed motors of the pole-changing type, or commutator motors with a special automatic regulator, the operation of which is explained. Other specific applications are also taken up. —*Electrician* (*England*), Feb. 27, 1925.

Electrophysics, Electrochemistry and Batteries

Effect of Surface Charges in Vacuum Discharge Tubes.—A. R. OLSON and T. F. YOUNG.—Current-voltage curves obtained with a four-electrode tube with two rather widely separated gauzes showed discontinuities that varied with the gas pressure. Tests were made from which it is concluded that in experiments in which the electron velocities must be known it is necessary that insulated "floating" surfaces must be avoided and that the potential of all parts of the wall must be controlled.—*Physical Review*, January, 1925.

Puncture Voltage of Solid Dielectrics.—R. DIETERLE.—In collaboration with K. W. Wagner, the author made extensive tests on the dielectric strength of various solid insulating materials, such as mica, glass, rubber, cellon and paper. The investigations covered puncture tests in air and under paraffine oil, currents from direct current up to 50,000 cycles alternating current, and time intervals of fractions of seconds up to thirty minutes. The results are the characteristics of the tested materials, given in tabulations and curves. The data for mica and glass showed great consistency, while the other materials were more or less erratic. The author ascribes this to the fact that mica is a natural substance and glass may be called so, while all the others are composites or synthetics. —*Elektrotechnische Zeitschrift*, March 5, 1925.

Traction

Virginian Railway Electrification.—HOMER K. SMITH.—Recent increases in terminal facilities necessitate an increase in the carrying capacity of the mountain section of this road which is to be met by electrification. The scheme adopted is similar to that of the Norfolk & Western, with single-phase, 25-cycle power at 11,000 volts or 22,000 volts, supplied through a phase converter on the locomotive to two three-phase induction motors, each driving, through a jack shaft and side rods, two driving axles. Three cabs or units will be semi-permanently coupled together into one locomotive, which will have a continuous tractive effort of 135,000 lb. with motor connections for 14 m.p.h. and a momentary maximum of 277,000 lb.—*Railway Review*, Feb. 21, 1925.

•*Mercury Vapor Rectifier Installation for the Railroad Bridge at Velsen*—L. P. KRYGER.—One of the largest swivel bridges in the world is operated by two 40-hp., 440-volt direct-current motors. To insure uninterrupted service a rectifier installation with batteries has been installed. Glass tube rectifiers of 200 amp. each are used. A complete description of the installation is given with eight photographs, curves and diagrams. The original steam-driven direct-current generator installation has been scrapped, as the operating cost of the rectifier arrangement is lower and is more reliable.—*Tijdschrift voor Electrotechniek*, February and March, 1925.

Telegraphy, Telephony, Radio and Signals

Artificial Resin Compound. — M. ADAM. — French chemists have developed a material that can be used instead of hard rubber for various electrical purposes, but primarily for panels of radio sets. "Orca," the name of this compound, is an artificial resin, produced by adding slowly an alkaline to acroleine, which causes a jellification of the liquid, progressing gradually until the mass becomes entirely solid and hard. This process is accompanied by a shrinkage in volume to one-quarter of the original. The resulting material is transparent, takes a beautiful polish, and can be readily machined. Sawing and turning should, however, be done in front of an air suction nozzle, because the resulting fumes are obnoxious. The compound resists sudden shocks, and is not affected by organic liquids like oils, alcohols and hydrocarbons, but is attacked by acids and metallic salts. It does not withstand prolonged heating to more than 100 deg. C., and is somewhat flammable. The electric resistance of this material is about 80 per cent that of amber.—*Radio Electricité*, Feb. 25, 1925.

Linear Frequency Bridge.—K. KUROKOWA and T. HOASHI.—A bridge composed of resistances in a pair of opposite arms and a capacitance and an inductance in the other two, each of the latter two having a resistance in series, is described as a new device to measure the frequency of alternating currents. By properly selecting the circuit constants the frequency may be given directly by the number of ohms of the resistance or any multiple of it.—*Journal of Institute of Electrical Engineers of Japan*, No. 437.

Miscellaneous

Production Costs and Material Prices in Engineering.—HUGH QUIGLEY.—This is an international comparison including graphical statistics covering iron, copper and labor costs for the important producing countries in Europe as well as the United States during the years 1920-1924. The writer's conclusions are directed to a consideration of the economic disadvantage of the British manufacturer of electrical machinery in the world's markets. From the data similar conclusions can be drawn for the American producer.—*World Power*, February, 1925.

Scientific & Industrial Research

[When investigations which have been completed are, in the opinion of the editors, of wide enough interest to the field we serve, details thereof will be presented in other parts of this paper. Contemplated research or that which appears to have limited appeal will be only briefly reported in this section, but details may be had by communicating with the investigator or institution named in the report. Readers are referred to the department "Digest of Electrical Literature" for investigations reported in other journals. The news and engineering sections should also be followed for research reported before technical societies.]

Research Completed

Electrons, Thermionic Distribution of Initial Velocities Among

The initial distribution of velocity components among thermionic electrons from tungsten has been carefully investigated by measuring the current to a cylindrical electrode from a coaxial tungsten filament over a very wide range of temperatures and voltages. The results are entirely in agreement with the assumption that thermionic electrons are emitted with components of velocity distributed according to Maxwell's law for an electron atmosphere in thermal equilibrium with the hot filament.—*L. H. Germer, Bell Telephone Laboratories, New York City.*

Ground Wire, Effect of

By means of the lightning generator in the Pittsfield laboratory it was found that a grounded wire placed near the line conductors reduces lightning voltages on transmission lines to less than half. Several ground wires reduce the lightning voltages still more. The ground wire was also demonstrated to be a good protector against direct strokes.—*General Electric Company, Pittsfield, Mass.*

Hydraulic Turbines, Pitting of Runners in

A report on the subject was read by Albion Davis at the February meeting of the Technical National Section of the N. E. L. A. in Cleveland. The report contains a compilation of data from companies representing about three-fourths of the total installed horsepower in the United States and Canada and is probably the first and most valuable compilation of actual experience data ever made.

Insulation Tests, Effect of Time and Frequency on

Tests have been made to determine quantitatively the variation of breakdown voltage on insulation with relation to the duration of application of the voltage and with further reference to the frequency of the alternations. These tests were applied particularly to determine the equivalent application of test voltage at higher frequencies than 60 cycles with reference to the minute test at 60 cycles. The data thus obtained have been used in the formulating of standardization rules for the future.—*Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.*

Meters, Lubricating Oils for

An investigation was made of the effects of different lubricating oils on pivots, lower jewel balls, upper bearings, etc. All commercially available samples of fish and mineral oils were included, and careful individual records of microscopic examinations have been maintained.—*Meter Committee of the N. E. L. A.*

Pumping Installation, Automatic Stopping of Motor in

When the tank is located at a considerable distance from the motor-driven pump, an electric control line (operated by a float) for stopping the motor when the tank is full becomes quite expensive. When the conditions are such that the motor is started by hand (but must stop automatically when the tank is full), the following arrangement can be used. The float simply stops the intake to the tank when a certain level has been reached. With a centrifugal pump its output immediately drops, and the electrical input into the motor is reduced accordingly. An underload relay then opens the circuit. (For details see *Brown-Boveri Mitteilungen*, 1924, Vol. 12, page 42.)

Sparking Potentials of Helium, Neon and Argon

The sparking potentials of helium and neon at pressures between 3 mm. and 25 mm. and of argon between 1 mm. and 15 mm. were determined for electrode separations of from 2 mm. to 5 mm. With pure aluminum electrodes Paschen's law holds for pressures greater than about 9, 12 and 3 mm. for helium, neon and argon respectively. For the minimum striking potentials, the values of *pd* (pressure in mm. times electrode separation in mm.) are about 35, 38 and 12.—*C. C. Van Voorhis, Princeton University* (work done in the research laboratory of the Westinghouse Lamp Company).

Turbine Spindles, Seasoning of

There has recently been devised and placed in operation an equipment for "seasoning" completed turbine spindles under operating temperature conditions before final balancing. This consists of a cast-iron heating box in which a fully bladed spindle can be heated to 400 deg. or 500 deg. F. or subjected to a vacuum while being rotated at 20 per cent overspeed. It has been found that spindles so treated and balanced run most satisfactorily when placed in service.—*Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.*

In Progress or Purposed

Electrolysis Through Glass, as a Sodium Voltameter

By the use of a light bulb immersed (with filament lighted) in molten sodium nitrate, sodium is driven electrolytically through the glass wall. From the weight of sodium thus deposited and the time integral of the current, Faraday's laws are checked, we believe, to 0.2 of 1 per cent. Further experiments are in progress to verify this more precisely. This makes available another form of voltameter.—*R. C. Burt, California Institute of Technology, Pasadena.*

Hydraulic Plants

The following subjects are among those being studied by the hydraulic power committee of the N. E. L. A.: Fishways, draft tubes, waterwheel testing and plant discharge, water-recording equipment, different types of dams, vibration of waterwheels, packing for turbine stuffing boxes, rubber-seal rings and guide bearings.

Lubricating Oils, Tests on

During the past year concurrent tests of lubricating oils have been made in the field and laboratory. These tests have brought out very conclusively the fact that with the oils tested heat and air were responsible for the oxidation and acidification of the oil, while the presence of water was responsible for the precipitation of sludge and the formation of emulsion. The data on various oils, so far as their life performance is concerned, are compared with laboratory tests of the same oils when new, in order to indicate the laboratory tests which distinguish between satisfactory and unsatisfactory lubricants.—*Prime Movers Committee, National Electric Light Association.*

Metals, Heating of, by High-Frequency Currents

There has been built for purposes of research a high-frequency, high-power oscillator. This is to be used in connection with work requiring the heating of small pieces of metal to high temperature by means of eddy currents.—*Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.*

Oils, Lubricating, Sludge Accelerator for

A laboratory device has been developed whose performance is quite similar to the turbine in its effect upon lubricating oils, with the exception that the action is produced in considerably less time, being about in the ratio of 1 to 100. This apparatus consists of a rectangular covered tank in which baffles are placed to lengthen the path of the oil. The oil is drawn from the last compartment and forced into the first by a small motor-operated pump. Ten per cent of water by volume is placed in this tank with the oil, and air is blown through it at the rate of 40 liters an hour. The resulting mixture is heated by burners placed under the tank and maintained at a temperature of 210 deg. F.—*Prime Movers Committee, National Electric Light Association, New York City.*

Quenching Media, Study of

Experiments are in progress with solutions of widely different physical properties in order to develop the factors contributing to high hardening power. The addition of a small fraction of 1 per cent of certain substances reduces the cooling velocity several times. Equipment is being made for a study of pressure quenching.—*Bureau of Standards, Washington, D. C.*

Suggestions for Research

Alternators, Protection of, Against Short Circuits

It has been recently proposed to use an earthing transformer rather than a resistance connected to the neutral point of the generator and a fuse inserted in the secondary of this transformer. When a fault develops to earth, the current in the transformer operates the main oil switch, and the current that flows in the secondary of the transformer causes the fuse to blow, so that the impedance in the earth circuit rises to the open-circuit impedance of the transformer. By this means the duration of the fault current is reduced to a very short time. It is desired to investigate experimentally the characteristics and the efficacy of this arrangement.

Ground Connections, Resistance of

Ground connections for lightning arresters and for protection of systems against transients must possess low resistance at high frequencies. The usual test at a low frequency does not give a reliable indication as to their effectiveness in actual service. It is desired to develop methods of measurement and to obtain the order of magnitude of the impedance of the customary ground connections at very high frequencies.

Core Loss in Machinery, Pulsation Loss

The core losses may be divided into three parts—the fundamental frequency losses, the surface iron losses and the pulsation losses. The first two components are known to a reasonable degree of accuracy, but there is need for much work on pulsation losses. These losses occur in the iron on each side of the air gap, owing to the slot openings on the other side. Also, when the winding arrangement permits it, induced currents and copper losses occur, and these currents reflect pulsations back to the other side of the gap. From the theoretical point of view the subject is quite complicated.—*P. L. Alger, General Electric Company, Schenectady, N. Y.*

Hydraulic Penstocks, Preventing Entrance of Sand Into

It is often necessary to install some device to prevent gravel, sand or silt from entering the conduit, because of the serious wear of the waterwheels. Just how far to go in the construction of these devices is an economic question. In one case, where the stream carried pumice, it was figured less expensive to renew periodically the turbine runner than to build works for removing pumice from the water. The turbine runner operating under a 500-ft. head was cut out in about six years of operation.

Iron, Sponge

If a piece of iron oxide be completely reduced at such a low temperature that no sintering or fusing takes place, then the piece of metallic iron formed has the same size and shape as the original piece of oxide. On account of the removal of oxygen, the structure is finely porous, exposing a large surface of iron. Such sponge iron is of importance as a metallurgical reagent in the electrolytic precipitation of copper, lead, etc., from solution. A process for production of sponge iron has been developed and further tests on a large commercial scale are much desired. For details see *Serial No. 2656 of the U. S. Bureau of Mines*, by Williams, Barrett and Larsen.

News of the Industry

Another High-Head Plant

Feather River Power Company Will Build 50,000-Hp. Unit on Stream's Middle Fork

CONSTRUCTION of a hydro-electric plant to cost $8,500,000, the first of six units, on the Middle Fork of the Feather River, in Butte County, Cal., will be started in a few weeks by the Feather River Power Company. At Buck's Creek a dam will be built which will impound 103,000 acre-feet of water. An 8-ft. x 7-ft. tunnel 26,000 ft. long will carry the water from the dam to the power house. The pressure pipe and penstocks will be approximately 5,000 ft. in length. The effective head will be 2,400 ft., and the plant will therefore rank with the projected Balch plant of the San Joaquin Light & Power Company (ELECTRICAL WORLD, April 4, page 730) as one of the two in America having the highest head, perhaps excepting the one supplying Colorado Springs, Col. The power house will produce 50,000 hp. The five other units, plans for which have already been drawn, will produce about 400,000 hp. They will cost from $45,000,000 to $50,000,000. The power to be produced by the first unit is already under contract by the Great Western Power Company for thirty-five years at an unusually low rate.

About six years ago the Constant Angle Arch Dam Company of San Francisco began quietly obtaining water and power rights on the Middle Fork of the Feather River and the lakes and streams that feed it. The dam company spent five years in surveying and mapping the area, the work costing approximately $2,000,000. As a result of the surveys, this company became convinced that the Middle Fork of the Feather River could be made one of the principal sources of power west of the Rockies. Then the Feather River Power Company was organized, and Karl Brehme, head of the dam company, was elected president. Brehme has been a dominant figure in the Constant Angle Arch Dam Company and the Feather River Power Company, and closely associated with him has been Lars Jorgensen, an engineer who has specialized on the problems connected with the harnessing of the Middle Feather.

Virginia Railway & Power May Change Hands

Rumors that the Virginia Railway & Power Company is to be taken over by one from among a number of large holding companies named and merged with other central-station companies in that region have led to much activity in the Virginia company's shares on the New York Stock Exchange, and their price has risen. Frank Jay Gould of New York, who is chairman of the executive board is believed to be the company's largest stockholder, and it has been asserted that he desires to dispose of his interest. From Richmond the statement is made that a syndicate is planning to acquire control of the Virginia Railway & Power Company and link a number of cities of eastern Virginia with eastern North Carolina in an extensive electrical system.

In the annual report of President Thomas S. Wheelwright, presented to the stockholders in Richmond on Wednesday, it was asserted that the Virginia Railway & Power Company last year acquired all but fifty-eight of 20,000 shares in the Roanoke Rapids (N. C.) Power Company at a cost of approximately $1,000,000 and is preparing for the construction of a 110,000-volt transmission line between Roanoke Rapids and Suffolk, Va., at an estimated cost of $800,000, including right-of-way. This line will connect with the existing system of the Virginia Railway & Power Company, which controls power, light and electric transportation in Richmond, Petersburg, Norfolk, Portsmouth and Suffolk and the intervening territories. According to Mr. Wheelwright's report, about $2,000,000 has been authorized for the 1925 construction program.

Francis Hodgkinson Gets Elliott Cresson Medal

At the Franklin Institute, Philadelphia, on Wednesday night the Elliott Cresson gold medal, one of the highest honors conferred by the institute, was presented to Francis Hodgkinson, chief engineer of the South Philadelphia works of the Westinghouse Electric & Manufacturing Company. The presentation of the medal was made by William C. L. Eglin, president Franklin Institute. The award, according to the official announcement, was in recognition of Mr. Hodgkinson's achievements in the field of steam-turbine design and construction during the past thirty-one years. The first commercial turbines in this country driving alternating-current generators were designed by Mr. Hodgkinson, installed in 1899 and are still in regular daily service.

Seven Hundred Attend Spring Convention

American Institute of Electrical Engineers Hears Notable Technical Papers and Enjoys an Ample Program of Entertainment in St. Louis

AN APPEAL to technical men to take a more active part in national affairs which involve questions of engineering was made by President Farley Osgood of the American Institute of Electrical Engineers as the keynote of his opening address at the spring convention of the Institute, which met at St. Louis from Monday to Friday of this week. Mr. Osgood dwelt upon the new aspect of power development brought about by interstate systems and urged his hearers to keep abreast of national development.

Seven hundred members of the Institute attended the convention, which scored the usual success of A. I. E. E. gatherings. The technical program embraced sessions on power plants, power transmission systems, machinery, communication systems, marine installations, mining electrification and industrial electric progress. Among facts brought out was that several American power plants have now attained an economy of 15,000 B.t.u. per kilowatt-hour. These plants operate with entire success, and new developments promise even greater economy.

The demonstration of a new hornless loud speaker at one of the technical sessions aroused special interest among the radio experts present.

The entertainment features of the convention were much enjoyed by those in attendance. They included a smoker, a golf tournament and ample provision for dancing. The ladies accompanying delegates were especially well looked after. Sight-seeing trips were freely patronized, and on Wednesday a special trip to the Cahokia plant of the Union Electric Light & Power Company, on the Illinois side of the Mississippi, was participated in by a great many of the engineers. At the banquet on Thursday evening Past-president F. B. Jewett spoke on "Present Aspects of Electrical Communication."

The ELECTRICAL WORLD'S résumé of discussions will be printed next week.

Agency Plan Is Approved for Hetch Hetchy Power

Unanimous approval was given by the Board of Supervisors of San Francisco at a meeting on April 13 to a plan to dispose of Hetch Hetchy power through the agency of the local power companies. The agency plan was proposed a week earlier by an advisory committee as the only feasible solution of the problem of disposal of the city's power until such time as the people of San Francisco shall have acquired a municipal distribution system or decided what shall ultimately be done. This action followed the failure of the city to receive any bids from municipalities or irrigation districts for the temporary purchase of the power. A special committee has been appointed to negotiate with the power companies to distribute the energy from the 80,000-kw. Moccasin power plant, which will be available at Newark, 30 miles from

San Francisco, in a period of sixty days. The City Engineer, it was stated, has been informally offered approximately $2,000,000 a year for the power by the private corporations. The advisory committee report approved by the Supervisors recommended that some plan be agreed upon whereby the city can lease facilities from one of the local companies on a flat-rate basis and sell power to the city's own consumers. A provision was included that any agreement entered into must be in conformity with the provisions of the Raker act, under which San Francisco came into possession of the Hetch Hetchy water rights. This act provides that the power cannot be sold to any private corporation for resale.

Large Project for Tennessee River Before Commission

The Southern Power & Light Company, a newly formed subsidiary of the Arkansas Power & Light Company, has applied for a preliminary permit covering a proposed project at Colbert Shoals on the Tennessee River. This site is 11 miles below Muscle Shoals. It is proposed to construct a dam 45 ft. high near the town of Waterloo. It is the intention of the applicant to install 100,000 hp. of generating equipment. The applicant announces that the project is to form a part of an interconnected system to cover Arkansas, Louisiana and Mississippi. It also is intimated that the Couch interests will attempt to obtain power from Muscle Shoals to feed into the new system. The proposed project at Colbert Shoals is to be connected with the lines of the Mississippi Power Company, the Louisiana Power Company and the Arkansas Light & Power Company, the applicant states.

The Missouri Power & Water Company has applied for a preliminary permit covering a project on Gasconade River in Pulaski County, Mo. The dam and power house are to be built a mile above Jerome, Mo. A reservoir of 800,000 acre-ft. capacity is to be created.

The Fern Gold Mining Company has applied for a license covering a small project on Archangel Creek in Alaska.

Detroit Edison's New Hydro Plant Nearly Ready

Sensational reports published in some newspapers last Tuesday to the effect that a large part of the Detroit Edison Company's new dam at French Landing, on the Huron River, about 25 miles from Detroit, had given way are emphatically denied by A. C. Marshall, vice-president and general manager of the company. The story, which has been contradicted by the press associations, said that the Ford Motor Company's dam at Flat Rock, further down the river, had also been washed out and that the resulting flood had caused much destruction and danger to life. It appears that the Ford dam did not give way and that the accident to the Edison company's dam was of a slight nature and that the breach can be speedily repaired at small expense.

The plant at French Landing is the sixth link in the Detroit Edison Company's chain of electric generating plants on the Huron River and will be in operation about the first of May, no delay because of the accident being anticipated. The new station, which will cost about $750,000, will add 3,200 hp. to the power reserve at the disposal of eastern Michigan's light and power users. Two generators, one rated at 1,200 kva. and the other at 2,400 kva., are being installed. They will generate electricity at 4,600 volts, which will be stepped up to 23,000 volts for transmission in the Detroit Edison Company's system. The effective head at which they will operate will be about 32 ft., with an average stream flow of about 500 cu.ft. per second. At this point on the river the effective drainage area is estimated at 825 square miles. The dam will create a 1,500-acre lake, extending about 6 miles upstream.

Donahey Attacks Utilities

Governor of Ohio Says Electric and Telephone Interests Oppose Commission Nominees

SPEAKING over the radio to the voters of Ohio last Monday evening, Governor A. V. Donahey of that state, who was elected by 176,000 majority last fall on the Democratic ticket, though the Legislature is strongly Republican, denounced the Bell Telephone Company and the Ohio Power Company, accusing them of attempting to defeat his nominees for membership in the Ohio Public Utilities Commission. These nominees are James W. Huffman and Earl D. Bloom, both attorneys, and their appointment to the commission has been held up in the State Senate. The retiring members—George T. Poor and Frank B. Maullar—who were appointed by former Governor Davis, are accused by Governor Donahey of having connived with his predecessor, with the Bell Telephone Company and with the Ohio Power Company to prevent the confirmation of the nominees. He accuses the Ohio Power Company of employing, at a large salary and on the solicitation of Commission Maullar, a lobbyist who, the Governor declares, represents the American Gas & Electric Company of New York, of which the Ohio Power is a subsidiary.

The Ohio Public Utilities Commission consists of only three members, of whom the terms of two have expired, and the Governor said that if he is to be prevented from reconstructing its membership in accordance with his pledges to the people, he will cease in this particular to be the real Governor. He made no specific charges against the hold-over commissioners except one of neglect of work. Commissioners Maullar and Poor, in a newspaper statement, denied that they had been guilty of either legislative lobbying or neglect of work and accused the Governor of misrepresentation, extreme partisanship and nepotism. They denied that there had been "any conspiracy, contact or concerted action between the utilities named and the commission" and complained that the Governor keeps unfounded charges against the commission on file for political purposes and has given the members no chance to meet them.

N.E.L.A. Section Committees' Pre-Convention Meetings

The executive committee of the National Electric Light Association met in New York on Tuesday of this week and discussed the report to be presented at the San Francisco meeting in June. The committee will meet again during the San Francisco gathering. The public policy committee of the association met in New York on Wednesday, only routine matters coming before it. Managing Director Aylesworth outlined the arrangements being made for broadcasting the San Francisco proceedings and also gave a list of prominent public men whom it is hoped to secure to address the convention. Acceptances have already been received from Secretary of Agriculture Jardine and E. N. Hurley, former head of the United States Shipping Board and Federal Trade Commission.

At last week's Louisville meetings of the committees of the Public Relations National Section sixty-five were present from all parts of the country. National President Griffith attended. Reports were presented for the approval of the executive committee of the section at its final meeting of the administrative year prior to the San Francisco convention in June. The reports as approved will be printed and presented at the Public Relations Section sessions in San Francisco. Charles Penrose of Philadelphia called the committee's attention to the valuable service rendered by the ELECTRICAL WORLD to the industry in Pennsylvania.

An outstanding feature of the Louisville meeting was the public address delivered by Samuel Insull on the functions of the holding company. This address was printed in part in last week's issue (page 782).

Wynooche River Project Still Far from Settlement

Disregarding the proposal for adjustment of the Wynooche River project made by the Grays Harbor Railway & Light Company as noted in the ELECTRICAL WORLD for March 21, page 634, the city of Aberdeen, Wash., has voted bonds in the sum of $700,000 for the purpose of extending the present city water supply system, and this result is likely to be followed by resubmission of the proposal to build a city power project on the Wynooche River. The bond issue for the power project will probably be in the neighborhood of $1,300,000, which with the $700,000 recently voted will total the $2,000,000 voted in 1923 for the combined water and power projects. It will be remembered that the courts threw out that vote on the ground that the two undertakings could not be joined as one for submission to the voters.

The fight between the city and the central-station company for rights to develop the water power of the Wynooche River will thus go on. It has been further complicated by the entry into the case of the Simpson Logging Company and the Polson Logging Company, which hold enormous timber holdings in the proposed power area and may start litigation.

Public Hearings on Muscle Shoals Unlikely

Written Opinions Solicited by Commission from Southeastern Power Companies, Henry Ford and Others—Technologist Appointed—Power May Bring $2,000,000

AFTER discussing some of the general phases of their work the members of the President's Muscle Shoals Commission have returned to their homes to take up individual study of the problem. Formal announcement was made of the commission's desire to receive in writing any views having a bearing on the disposition of the government's properties. Five copies of each communication are requested so that each commissioner may be supplied with one. Specific requests for expressions of opinion will be sent out to the Southeastern power companies, Henry Ford and others who have made studies of the possibilities of the project. By obtaining written statements the commission hopes to avoid the holding of public hearings.

Under the provisions of the national defense act, which authorizes the employment of experts and others needed in connection with the Muscle Shoals development, the President has appointed W. G. Waldo as the commission's technologist and W. E. Murray to be secretary of the commission. Mr. Waldo is a civil engineer, a graduate of the Massachusetts Institute of Technology, who has been associated with the project since its inception as engineer for the Tennessee River Improvement Association.

After receiving its instructions from the President the commission conferred with acting Secretary of War Davis, Dr. Ball, the director of research for the Department of Agriculture, and Dr. Cottrell, the director of the fixed-nitrogen laboratory of the Department of Agriculture. Secretary Hoover was invited to confer with the commission, but he suggested that his appearance be delayed until the commission had progressed further with its study. When Secretary Davis told the commission that the War Department is planning to lease the power on a temporary basis pending its final disposition by Congress, determined objection is understood to have been voiced by one of the members of the commission. His thought was that the power once leased could be called back only under great difficulties. The point also was made that Congress would act more promptly on the whole question were the disposition of power held in abeyance.

During about four hours of discussion the other side of the question was developed. The point was made that it would not be in accordance with the spirit of the President's economy program to allow this power plant to stand idle when the output could be sold readily for $1,500,000 or $2,000,000 for a period which would include two low-water seasons. In addition, the government would be relieved of an expense of $500,000 for maintenance.

Power May Bring $2,000,000

An investigation made on behalf of the Secretary of War discloses that the power can be sold on an eighteen months' contract, with a clause providing for termination at any time during the life of the contract on thirty days' notice, for at least $1,500,000. Colonel Spalding, the engineer officer in charge of the work, believes that $2,000,000 can be obtained for it. In addition to the losses to the government were the plant allowed to stand idle, there would be greater losses to industry throughout the Southeast. Should the steam plant lease be terminated and the hydro-electric power at Muscle Shoals withheld during the coming season of low water, 30,000 hp. of industrial capacity could not be supplied. The result would be the disruption of industry and the throwing out of employment of thousands of persons.

As this is written, the Acting Secretary of War has not announced whether or not the plan to advertise for bids for the power will be carried through. It is assumed that he will not decide absolutely until he has conferred with the Secretary of War or the President. The health of Secretary Weeks may preclude his participation in the determining of this question.

The General Electric Company has promised to have the switchboard installation ready at the government's plant by August 1, which means that all of the power which can be developed will be available on that date. The construction work is being rapidly brought to a close.

The commission was advised that a special report on Muscle Shoals would be submitted at once by Samuel S. Wyer. The commission will reassemble early in May. Its report must be in the President's hands November 15.

Edward D. Adams Honored

Many men prominent in the electrical industry joined with well-known citizens from other walks of life on Thursday evening, April 9, in tendering a testimonial dinner to Edward Dean Adams, engineer, financier and philanthropist, to whose early efforts the development of power at Niagara Falls is in such large measure due. The dinner, which took place on Mr. Adams' seventy-ninth birthday, was held at the Hotel Waldorf-Astoria, New York, and three hundred were present. Dr. W. F. Durand, president of the American Society of Mechanical Engineers, was in the chair. Letters of congratulation were received from Canada, England, France and Germany, besides a great many from the United States. In one of the latter Thomas A. Edison paid tribute to Mr. Adams as "pioneer engineer and financier of Niagara power development."

Appreciative reviews of Mr. Adams' career were made in speeches by A. Monro Grier, president of the Canadian Niagara Power Company, who dwelt also on the friendly international relations existing between the United States and her northern neighbor, and by William Nelson Cromwell, the eminent lawyer who played a leading part in paving the way for the Panama Canal. Mr. Adams made an appropriate and feeling address in response to the honor paid him.

Charles F. Rand, former chairman of the Engineering Foundation; Edward E. Bartlett and John L. Merrill were joint chairmen of the dinner committee, of which Alfred D. Flinn was treasurer. Those on this committee who are promi-

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MEMBERS OF PRESIDENT'S MUSCLE SHOALS COMMISSION

Left to right—R. F. Bower, former head American Farm Bureau Federation; former Senator N. B. Dial of South Carolina; former Representative J. C. McKenzie of Illinois (chairman); William McClellan, New York; Prof. H. A. Curtis, Yale.

nently connected with the electrical profession or art, besides Mr. Edison and Mr. Grier, were General J. J. Carty, Gano Dunn, Dr. Alexander C. Humphreys, Charles R. Huntley, Samuel Insull, Dr. F. B. Jewett, Dr. A. E. Kennelly, John W. Lieb, Thomas N. McCarter, Dr. R. A. Millikan, W. W. Nichols, W. H. Onken, Jr., Farley Osgood, Dr. M. I. Pupin, Dr. Charles F. Scott, Frank J. Sprague, Lewis B. Stillwell, Dr. S. W. Stratton, General Guy E. Tripp, H. H. Westinghouse and J. G. White.

For Free Interstate Exchange of Power

Executive Secretary Merrill of the Federal Power Commission Against Artificial Restrictions—United States Should Act Only Where States Cannot Regulate

AS AN outcome of the discussion of interstate regulation of power which has arisen over the proposed development at Conowingo on the Susquehanna River, O. C. Merrill, the executive secretary of the Federal Power Commission, has expressed the following views:

"Judging from the present trend in power development and distribution, it is a matter of a few years only when high-tension transmission lines will be crossing state boundaries in every direction and we shall have individual interconnected systems serving areas in several states, even if we do not have a single system covering our whole Northeastern industrial area. Such a result not only is inevitable but will lead to better service and lower rates, provided there is intelligent public supervision and regulation. The complications which will be involved in the attempt to manage such great properties, if management includes generation, transmission, distribution and sale, will tend to bring about a separation between generation and transmission on the one hand and distribution and sale on the other. If this happens, the regulation of rates and services will be primarily a regulation of distribution. Service to the consumer is a question of distribution. Probably not less than three-fourths of the cost of service is distribution cost. Distribution then could be required to be performed by corporations organized within a state and rendering service only in a single state. Regulation of generation and transmission, on the other hand, would be primarily a matter of preventing discrimination between different states or between different sections of the same state.

Energy Pool Versus Zoning System

"If the energy developed from hydroelectric and steam plants thus can be turned into a common energy pool, we can take advantage of the economies in operating expense and capital requirements which large-scale production can afford, and we can have energy delivered to the distributing agencies, whether corporate or public, at uniform rates for the same quantity and character of service. I believe such a policy would be preferable to the zoning system followed by the Ontario Hydro-Electric Power Commission, whose policy naturally must result in the concentration of industry and of population in those communities where power rates are the lowest. A policy of uniform rates over a large territory would tend to decentralize industry and to avoid the constantly increasing concentration of population in larger cities.

"Looking forward as I do to the development of the power industry along the lines I have outlined, I believe we should adopt state and national policies in harmony with such development and should not place artificial restrictions upon the free interchange of power between states. No one would suggest the necessity or the desirability of permitting a township or a county within a state to recall, at its option, power produced within its borders which was being used in some other township or county. There would be no need of such a step because the state has a public service commission which can prevent discrimination between the several counties or townships of the state. The creation of some agency which can prevent discrimination between different states is a wiser social and economic policy than one which would seek to guard the state's interests by placing even a conditional embargo on the export of power. Even if the latter were not a policy of doubtful legality, such a policy would be particularly unwise in most states, since they draw a considerable amount of power from adjacent states. Most states will have to look forward to a constantly increasing dependence in the future on outside sources for their power requirements.

For State Regulation

"I am one of those who believe that utility regulation should be left to the states to the full extent of their power, but it is very doubtful if the states individually have complete authority in cases of interstate transmission and sale. If they do not have it or cannot get it, then I believe the United States should act, but only with respect to those matters which are beyond the powers of the states.

"The right to regulate the rates and services of the public utility corporations of a state is an attribute of state sovereignty the exercise of which becomes effective to the degree that the states, through appropriate legislation, provide the means for its exercise. The state cannot divest itself of this right, unless perhaps temporarily, by specific contractual or legislative agreement. The same situation exists respecting such powers as the state may exercise through interstate agreements. No rights can be acquired by private interest adverse to these inherent rights of the states to regulate public service corporations, unless the states by their own action create such adverse rights. If they do, they can abolish them at their option."

Tax on Municipal Plants in California Defeated

The constitutional amendment providing for the taxing of publicly owned utilities in the same manner as privately owned utilities are taxed was beaten in the California Legislative Assembly on April 9 by a vote of forty-five to twenty-eight. Fifty-four votes were necessary to pass the measure. This bill had the support of the California Farm Bureau Federation, and the law and utilities department of that organization addressed to the members of the Legislature an appeal in favor of the proposed law. In this, after a general argument on the importance of fair and equitably distributed taxation, the federation said:

"The advocates of public ownership do not claim that such enterprises are too unprofitable to pay their just share of the cost of government, nor can they assert that they derive no benefit from or entail no expense upon government. The issue then resolves itself into a question as to the willingness of the users of the services of publicly owned enterprises to deal fairly and justly with other taxpayers."

Biennial Effort to Abolish the Tennessee Commission Fails

The biennial attempt to abolish the Railroad and Public Utilities Commission of Tennessee has failed in the 1925 session of the State Legislature, and hope is expressed by the friends of commission regulation that the endeavor has been finally disposed of and will not be renewed two years hence. The Senate defeated the measure to repeal by a vote of seventeen to thirteen, despite a last-moment effort of Governor Austin Peay, who urged the Democratic Senate to carry out this provision of the Democratic platform on which he was elected. A number of amendments to the present public utility law were introduced subsequent to the defeat of the repeal measure, but none of them passed.

Since the establishment of commission control in Tennessee by the Legislature of 1919 both the chief parties have adopted platform pledges calling for its repeal. It is considered probable now, however, that with the commission firmly established and its duties and importance fully understood such efforts will henceforth be discontinued. Much of the early resentment against the commission is attributed to its actions in the abrogation of contracts which were rapidly plunging the public service companies of the state into bankruptcy. Under commission control the public service companies' properties have been rehabilitated and extensions of service are progressing at a more rapid rate than ever before.

It was particularly significant to the Legislature at this session that the State League of Municipalities, which two years ago urged the abolition of the commission, desisted from its contentions and that many who were opponents at that time have become advocates of the commission. This was particularly true of newspaper comment in the state.

Activity in Texas

From All Parts of the Lone Star State Come Reports of Electric Progress

CONSTRUCTION of an electric power plant and transmission system that will cover virtually all of southeast Texas, extending from the Louisiana line to points 25 to 150 miles east and north of Houston, will take place as a result of a contract just entered into between representatives of Stone & Webster of Boston and the Western Public Service Company of Colorado Springs, Col. Following a conference just held at Houston between Ralph Y. Pool of Colorado Springs, vice-president of the Western Public Service Company; Paul Freeman, manager of the company's Texas properties, and Luke C. Bradley, manager of the east Texas properties of the Stone & Webster interests, the official announcement was made that Stone & Webster would extend their power line from Beaumont to Sour Lake and furnish the Western Public Utilities Company with electric energy generated at Port Arthur.

This power-line extension will connect with that of the Western Public Utilities Company at Sour Lake, and the electrical energy will go to supply that company's properties at Sour Lake, and nineteen other small communities. In order to supplement this power a large central station will be constructed by the Western Public Utilities Company at some point in the western part of the district that is to be served. In addition to the towns already embraced in the system others, it is understood, will be added from time to time. This combination of electric power interests will, when its plans are rounded out, not only cover all of southeast Texas but may reach well into central Texas.

At Houston and San Antonio

The Houston Lighting & Power Company has bought the electric light and power plants at Rosenberg, Richmond and Wharton. A new 66,000-volt transmission line is being constructed from the Houston company's Deepwater plant on the Houston Ship Channel, and when completed an abundant supply of electricity will be available in each town to be served. Right-of-way has been obtained as far as Rosenberg and is being acquired for the remaining portion of the line, which soon will be completed into Wharton, about 60 miles from Houston. The company has also bought the plant at Goose Creek.

The Comal Power Company of San Antonio has just awarded the contract for the construction of the first unit of its proposed 100,000-hp. hydro-electric plant on the Guadalupe River near New Braunfels. The Comal Power Company is a subsidiary of the San Antonio Public Service Company. It is stated by E. H. Kifer, vice-president and general manager of the company, that the U. G. I. Contracting Company of Philadelphia is the successful bidder for the first unit of the plant. This unit will be of 30,000-hp. capacity and will cost approximately $3,000,000, he said. Under the contract the plant will be completed, machinery installed and ready for operation in November, 1926. Actual construction work will begin early this fall. When the plant is placed in operation the power supply of the San Antonio Public Service Company will be increased approximately 70 per cent. The new plant will be tied in with the Concepcion Road plant of the San Antonio Public Service Company, and it is planned to serve San Antonio and adjacent territory with power.

In Western Texas

The Texas Utilities Company of Plainview, a North American Company property, which is reported to have purchased the electric light and power plant of the Slaton Power & Light Company and is to connect Slaton with its power transmission system in the South Plains region of northwestern Texas, plans to spend $3,000,000 for power development in its territory, where population is increasing.

The last pole of the high-tension line of the West Texas Utilities Company connecting Ballinger with Santa Anna, about 40 miles distant, has been set and the wire strung. The new line will also serve Talpa and Valera and assures Ballinger of two-way service over the West Texas Utilities Company's lines, as there is an interconnection just east of Santa Anna with the Texas Light & Power Company. The next step will be to build a line between Winters and Ovalo, which will tie all of the Runnels, Tom Green and Coleman County lines into the main transmission network of the West Texas Utilities Company.

Commercial Men Meet on Pacific Coast

The last conclave of the Commercial Section of the Pacific Coast Electrical Association was held at Fresno, Cal., April 3 and 4, at which time the various bureaus reported on the work of the year. One of the outstanding accomplishments was the holding of two lighting schools to train men in the industry in the fundamentals of illumination. One school was held in Los Angeles and the other in Oakland. One hundred and three contractors, jobbers' salesmen, architects and engineers, central-station employees and fixture manufacturers attended the schools.

The Customers' Relations Bureau did a notable piece of work in the preparation of a manual to guide employees in their daily relations with the public. The Transportation Bureau has prepared a group of sales letters on the electric truck to be sent to central-station executives and sales managers and plans to hold an electric truck school in San Francisco in the week prior to the national convention in June. The Power Bureau has devoted its time to a study of industrial heating applications, electricity in competition with isolated plants and electricity in agriculture. This bureau also hopes to hold a school in San Francisco during the week preceding the convention. A thorough investigation of metered water heating was made by the Heating and Cooking Bureau. A sub-committee of this bureau prepared a report on air heating, giving many data in tabular form.

All meetings at Fresno were general and well attended. Commercial Section meetings of the association at the annual convention in June will be combined with the corresponding meetings of the national committee.

Troubles of Colorado Pact

California Now Imposes Boulder Canyon Reservation in Ratifying Six-State Treaty

THE six-state Colorado River compact sponsored by Colorado was ratified with a reservation by the California State Senate on April 2, the measure having previously been passed by the Assembly. Ratification of the agreement was made contingent upon the erection by the federal government of a storage dam and reservoir at or near Boulder Canyon.

According to expert opinion, this action not only nullifies the six-state compact approved by Colorado, Utah, Wyoming and New Mexico, but abrogates the unconditional ratification by California two years ago of the original seven-state pact. Ratification by the California Legislature with the reservation came in the face of protests from Secretary of Commerce Hoover, representative of the federal government in the disposition of the Colorado River matter. It is believed that the reservation demanded by California coupled with those imposed by Arizona and the obstructive tactics of the Governor of the last-named state (ELECTRICAL WORLD, March 14, page 577; March 28, page 679, and April 11, page 783) will form a further obstacle to a speedy settlement of the Colorado River question.

New Mexico Association's Spring Convention Off

Plans for holding the annual convention of the New Mexico Electrical Association during the spring season have been definitely abandoned. The dates April 21-23 have been canceled and, according to B. L. Wiles, secretary of the association, an effort will be made to obtain as large a delegation of New Mexico utility men as possible to attend the annual convention of the Rocky Mountain Division, N. E. L. A., at Glenwood Springs, Col., in September.

Officers of both the division and the Colorado Public Service Association at a meeting last week extended a formal invitation to the New Mexico group, with the assurance that at least one day of the joint convention would be devoted to its special requirements if desired. Although no decision has been made on this feature, the officers of the Colorado group approved a plan to make the coming joint convention one of four days' duration rather than three as has been the practice for more than twenty years. With such an arrangement, according to E. A. Phinney, general manager of the Jefferson County Power & Light Company, who has been redesignated as general convention chairman, daily sessions will be held from 9 a.m. until 1 p.m. with several night programs. Definite dates for the Glenwood convention have been established as September 14-17 inclusive.

Utica Company's New Plant

Harbor Point Station, with Ultimate Rating of 150,000 Kw., to Be Ready Next January

CONSTRUCTION of the new 60,000-kw. Harbor Point steam station of the Utica Gas & Electric Company is rapidly progressing. All the steel work on the structure is already completed, and it is expected that the plant will go into operation in January of next year. The structure under way is being built for a capacity of 60,000 kw., although when first placed in operation only two 15,000-kw. turbo-generators will be installed. These will be followed later by a 30,000-kw. unit. The complete development, based on the amount of condensing water available, will be for 150,000 kw. All additions to be made after the initial 30,000 kw. will be in units of 30,000 kw.

This augmentation of the Utica system is very essential, although the Harbor Point station will be inherently a standby for the hydro-electric energy available in that section. At present the connected generating capacity is 51,900 kw., and on a contract basis 15,000 kw. is being taken from the Northern New York Utilities, Inc. In July, 1925, this will be increased to 20,000 kw., and finally in July, 1926, to 25,000 kw. There is also an interconnection with the Adirondack Power & Light Company amounting to 7,000 kw. at 13,200 volts and 20,000 kw. at 66,000 volts.

When it is necessary to add the contemplated units to the system, it is intended that a high-tension substation shall be erected about two miles from Utica, and from this point energy will be transmitted to other parts of this system at either 44,000 volts or 110,000 volts. The Harbor Point plant itself, as mentioned above, will have two 15,000-kw. Westinghouse turbo-generators. Four Connelly boilers, rated at 1,610 hp. each, are to be installed. Each boiler is equipped with water-cooled side walls and bridge wall at boiler pressure. The steam pressure is 275 lb. at the throttle of the machines with 125 deg. superheat. Taylor stokers made by the American Engineering Company with fourteen retorts and thirty-three tuyères wide, with clinker grinders, are to be used. It is expected that the four boilers will be sufficient for 60,000 kw. capacity. "Elesco" superheaters made by the Superheater Company are being used.

Two 20,000-sq.ft. C. H. Wheeler condensers serve the two turbo-generators. The circulating water for each condenser will be supplied by two entirely separate pumps, one motor-driven and the other steam-driven. Owing to the soil conditions, it will be impossible to use tunnel construction for the circulating water. Two intake lines consisting of 42-in. cast-iron pipe will supply each condenser, the discharge going to a manifold which will be common to the two 15,000-kw. machines and the first 30,000-kw. machine to be installed later. This is drained by an 84-in. cast-iron pipe. All main station auxiliaries are to be driven by both steam and electricity; that is, a steam unit and a motor-driven unit operate independently of each other.

When the first two units go into operation they will be tied in to the Washington Street substation, a short distance away, by a double-circuit 1,000,000-circ.mil, 13,200-volt line.

Hydro-Electricity and Mining in Canada

Particulars of recent water-power developments in Canada designed to serve the mining industry are given in a bulletin just issued by the Dominion Water Power and Reclamation Service of the Department of the Interior. In British Columbia the West Kootenay Power & Light Company has entirely demolished its 4,016-hp. plant at Lower Bonnington Falls, on the Kootenay River, and has commenced the construction of a plant to have an ultimate capacity of 60,000 hp., of which 40,000 hp. will be installed during 1925. In northern Ontario the Hollinger Consolidated Gold Mines, Ltd., has completed a 24,000-hp. development on the Abitibi River at Island Falls. The Northern Ontario Light & Power Company has increased the capacity of its Matabitchuan station to 13,200 hp.; the South Bay Power Company has increased the capacity of its plant, and the Lorne Power Company has added a 2,750-hp. unit to its Nairn Falls station on the Spanish River. In Quebec the Quinze Power Company has installed 20,000 hp. at Ke Kek Falls on the Quinze River.

Briefer News

Florida Debates Revocable-Permit Law.—A measure practically identical with the revocable permit law adopted by the Oklahoma Legislature this year is now before the Legislature of Florida.

Floodlighting Lexington's Minuteman.—As its contribution to the one hundred and fiftieth anniversary of the battle of Lexington on April 19-20 the Edison Electric Illuminating Company

of Boston, Mass., is floodlighting the famous "Minuteman" statue on Lexington Green, the scene of the first bloodshed in the Revolutionary War. The statue is illuminated by a battery of four 500-watt General Electric "L-1" units mounted on a pole 90 ft. distant and 27 ft. above the ground. A fifth 500-watt "L-15" unit beside the battery illuminates the national colors on a staff rising from the historic spot. Permanent floodlighting of the "Minuteman" is under consideration by the town authorities as a result of the effectiveness of the anniversary display.

Coast Valleys Company to Establish Switching Center in Salinas, Cal.—A substation to be the company's principal transmission switching center is being built in Salinas, Cal., by the Coast Valleys Gas & Electric Company at a cost of $436,000. The station will serve Monterey County and part of San Benito County. Sixteen transformers will be installed.

Sacramento Wants Distributing Systems Appraised.—The board of directors of the Sacramento Municipal Utility District have passed a resolution requesting the California Railroad Commission to make an immediate appraisal of the power distributing systems of the Great Western Power Company and the Pacific Gas & Electric Company within the utility district. The object is to have a price on the systems in case the city of Sacramento decides to purchase them to use in distributing the power to be generated at the city's proposed Silver Creek water and power project.

East Georgia Power Company Seeks to Build 112-Mile Transmission Line.—The East Georgia Power Company, with an authorized capital of $5,000,000, is seeking incorporation in order to construct a transmission line from Toccoa, Ga., to a point 8 miles from Augusta, where it will be connected to the lines of the Georgia-Carolina Power Company. The latter company will purchase the power transmitted over this line from the system of the Georgia Railway & Power Company. The project involves the construction of 112 miles of 110,000-volt line with "A-" frame steel construction. Rights-of-way are being acquired and orders for construction materials have been placed.

Another Defeat for Public Ownership.—The voters of Faribault, Minn., have defeated a proposal for the erection of a municipal light and power plant by a majority of two to one. Faribault has a population of more than eleven thousand and is headquarters for the Faribault division of the Northern States Power Company, this division supplying twenty-nine other places directly with electrical energy, besides selling at wholesale to eight communities and four distributing companies. The division has a steam plant at Faribault and a hydro-electric plant at Cannon Falls and reaches a population of 48,500.

Another Unit at Big Creek Plant No. 2.—On March 31 a fourth generating unit of 17,500 kva. was placed in operation at Big Creek plant No. 2 of the Southern California Edison Company. The unit is of the horizontal type and is driven by a 22,000-hp. Pelton impulse waterwheel operating under a head of 1,680 ft. Precipitation in the Big Creek territory this year continues above the average, and it is expected that the major portion of the system load can be carried by the hydro-electric plants, using the new units recently installed at the Long

Beach steam station for block steam power. The highest peak ever reached on the Southern California Edison system — 335,800 kw. — was recorded recently. This figure is 10,000 kw. greater than was predicted two years ago.

Samuel Insull to Address Purdue University. — "Superpower Day" at Purdue University is scheduled for Wednesday, April 22. A banquet in honor of Samuel Insull, president of the Commonwealth Edison Company of Chicago, will be held in the Purdue Memorial Union Building, followed by an address by Mr. Insull in Fowler Hall.

Newport (R. I.) Utility Changes Hands.—Announcement was made this week that the Utilities Power & Light Corporation, which has its offices in Chicago, has acquired control of the Colonial Gas & Electric Company of Newport, R. I. The purchase carries with it control of the Newport Electric Corporation, which serves Newport, Jamestown and Portsmouth, R. I., with electric light and power and operates an interurban railway between Newport and Fall River, Mass.

Fitkin & Company Get Kansas Central-Station Company.—A. E. Fitkin & Company have announced the purchase of the Electric Service Company of Kansas, serving Dodge City and thirteen other communities. It will be operated in conjunction with the Kansas Power Company of Concordia, another Fitkin property.

New England Executives to Discuss Accounting.—Five-minute addresses on "The Value of the Accountant from the Viewpoint of the Management" will be a feature of the annual meeting and election of officers of the New England Division, N. E. L. A., to be held at the Copley Plaza Hotel, Boston, April 24, following a luncheon at 12:30 p. m. The speakers will be C. L. Edgar, president Edison Electric Illuminating Company of Boston; E. A. Barrows, president Narrangansett Electric Lighting Company, Providence; George W. Hurn, manager Haverhill (Mass.) Electric Company, and Wallace B. Donham, dean of the Harvard Graduate School of Business Administration. The annual convention of the division will be held at the Hotel Griswold, New London, Conn., September 8-11.

Inquiry to Be Made Involving Hydro Power from Hudson Bay.—A resolution has been presented to the Ontario government by the Associated Boards of Trade of Ontario opposing the diversion of any waters on the Hudson Bay slope, which is being considered by the Ontario Hydro-Electric Power Commission, until such time as a complete report on Canadian resources is compiled and careful inquiry made concerning the possible effects of such diversion. After it had been suggested that there was a danger of ruining part of the 60,000-square mile watershed and prejudicing the future of a potentially valuable territory, Premier Ferguson said that the government did not propose to take any action hastily and would especially survey the situation.

Indianapolis' New Street-Lighting Installation.—Work has begun on the installation of a new street-lighting system in Indianapolis which will involve the erection of 2,522 new standards. On the downtown streets 225 double-unit 20-ft. standards will supply 3,000 cp. each, or twenty times more light than that developed by the present equipment. On main arteries 1,148 15-ft. single-unit standards will increase the present volume of light ten times. In the residential and less-traveled streets 1,149 12-ft. standards will also increase tenfold the light now supplied. Corner arc lamps are to be replaced with incandescent equipment. The units are all of General Electric manufacture, and a ten-year contract with the Merchants' Heat & Light Company has been entered into. The installation will, it is expected, be completed in October.

Coming Meetings of Electrical and Allied Societies

[A complete directory of electrical associations, with their secretaries, is published in the first issue of each volume. For latest list see ELECTRICAL WORLD, January 3, page 76.]

Southwestern Division, N. E. L. A.—Eastman Hotel, Hot Springs, Ark., April 21-24. S. J. Ballinger, San Antonio Public Service Co., San Antonio, Tex.

Arkansas Utilities Association—Hot Springs, Ark., April 21-24. R. I. Brown, Arkansas Central Power Co., Hot Springs, Ark.

American Welding Society—New York, April 21-26. Miss M. M. Kelly, 29 West 39th St., New York.

American Electrochemical Society—Niagara Falls, N. Y., April 23-25. C. G. Fink, Columbia University, New York.

Southwestern Public Service Association—Rice Hotel, Houston, Tex., May 5-8. E. N. Willis, 403 Slaughter Bldg., Dallas.

American Institute of Electrical Engineers—Swampscott, Mass. (regional), May 7-9; Saratoga, N. Y., June 23-27. F. L. Hutchinson, 33 West 39th St., New York.

Missouri Association of Public Utilities—Joplin, Mo., May 7-9. F. D. Beardslee, 315 North 12th St., St. Louis.

American Society of Mechanical Engineers—Milwaukee, May 18-21. C. E. Davies, 29 West 39th St., New York.

Southeastern Water and Light Association—Hotel Patten, Chattanooga, Tenn., May 19-21. W. F. Steiglitz, Columbia, S. C.

Electrical Manufacturers' Club—Hot Springs, Va., May 19-22. S. B. Belden, Jeffrey Manufacturing Co., Columbus, Ohio.

Middle West Division, N. E. L. A.—Hotel Fontenelle, Omaha, Neb., May 20-22. (Conjointly with Nebraska Section.) H. M. Davis, Fraternity Building, Lincoln, Neb.

Georgia Electrical Association—Atlanta, May 21-22. W. W. Barr, Georgia Railway & Power Co., Atlanta.

Electric Power Club—Hot Springs, Va., May 25-28. S. N. Clarkson, B. F. Keith Bldg., Cleveland, Ohio.

Electrical Supply Jobbers' Association—Hot Springs, Va., June 2-5. Franklin Overbagh, 411 S. Clinton St., Chicago.

American Association of Engineers—Orlando, Fla., June 2-5. C. E. Drayer, 63 East Adams Street, Chicago.

Iowa Section, N. E. L. A.—Waterloo, Iowa, June 3-4. H. E. Weeks, 623 Union-Davenport Bldg., Davenport.

National Electrical Credit Association—Atlantic City, June 6-7; Philadelphia, June 8-9. F. P. Vose, Marquette Bldg., Chicago, Ill.

Associated Manufacturers of Electrical Supplies — The Homestead, Hot Springs, Va., June 8-12. F. Nicholas, 30 East 42d St., New York.

Northwest Electric Light and Power Association (Geographic Division N. E. L. A.)—Gasco Bldg., Portland, Ore., June 12. W. A. White, Puget Sound Power & Light Co., Portland.

Pacific Coast Electrical Association (Geographic Division N. E. L. A.)—San Francisco, June 15. S. H. Taylor, 529 Rialto Bldg., San Francisco.

National Electric Light Association—San Francisco, June 15-19. M. H. Aylesworth, 29 West 39th St., New York.

Society for the Promotion of Engineering Education — Union College, Schenectady, N. Y., June 17-20. F. L. Bishop, University of Pittsburgh, Pittsburgh.

New Transmission Line from Fort Madison to Burlington, Iowa. — The Iowa Southern Utilities Company, Centerville, Iowa, has entered into a contract with Stone & Webster, Inc., for the construction of 22 miles of double-circuit, 66,000-volt tower line from Fort Madison to Burlington, Iowa. The new line replaces an old one and will provide for the immediate demand and future growth of the power and lighting load in Burlington. Since the recent acquisition of the Burlington property the Iowa Southern Utilities Company has added 700 customers, and it is preparing to take on 5,000 kw. of new power and heating load. The power transmitted over the new line will be purchased from the Keokuk plant of the Mississippi River Power Company.

Inland Power & Light Company, Instead of City of Lewiston, Idaho, May Build Plant on Clearwater.—A proposal has been made to the city of Lewiston, Idaho, by the Inland Power & Light Company of Portland, Ore., and the Clearwater Timber Company that if the city will withdraw its application to the Federal Power Commission for permission to develop power on the Clearwater River and will obtain the necessary lands and rights-of-way, the power company will build a dam and power house and furnish energy for a great sawmill to be built by the timber concern as well as for general purposes. A 10,000-kw. plant is contemplated. The City Council was considering a special bond election to be held on May 6 to authorize the municipal project at a cost of $1,500,000, but action on this plan was deferred to permit consideration of the companies' offer.

Governor Smith Signs Barge Canal Electricity Bill. — Governor Smith of New York has signed the Truman bill providing for sale of electrical energy generated at the state-owned hydro-electric plant at Crescent Dam and Vischer's Ferry, on the canalized waters of the Mohawk River, to the highest bidder instead of limiting its distribution to municipalities as originally provided. Cities and villages in the capital district in conference last winter evinced inability to use this electricity owing to existing long-term contracts with private companies and want of distribution facilities. The new law also authorizes the Water Power Commission to collect rental for use of surplus waters of the Barge Canal for power purposes. As finally passed by the Legislature, the $250,000 appropriation to complete the Crescent Dam project was eliminated from the bill. It is claimed that there is sufficient money on hand to complete the work.

Men of the Industry

W. W. Erwin Receives Promotion

W. W. Erwin, for the past seven years chief operating engineer of the New York Edison Company, has been appointed controller of the company to succeed C. S. Shepard, who has retired. Mr. Erwin entered the employ of the New York Edison Company as draftsman in 1900. Five years later he became leading mechanical draftsman and in 1906 was made superintendent of construction. In the spring of 1918 Mr. Erwin was appointed to the office which he has just surrendered to accept promotion.

H. N. Landaal has been appointed manager of the electrical properties of the Wisconsin Power & Light Company at Horicon, Wis.

O. P. McCary, formerly manager of the properties of the East Texas Public Service Company at Mineola, has been transferred to Winnsboro as district manager.

W. L. Rush, formerly distribution engineer of the Ohio Public Service Company at Lorain, has recently joined the Mississippi Power Company at Jackson.

Frank P. Lannon of Pueblo has been appointed chairman of the Public Utilities Commission of Colorado by Governor Morley to succeed Grant Halderman, whose term has expired. Mr. Lannon has been a member of the commission for the past four years.

R. E. Harford, formerly superintendent of the People's Gas & Electric Company of Oswego, N. Y., has resigned to affiliate himself in a similar capacity with the Empire Gas & Electric Company at Auburn, N. Y. Mr. Harford was associated with the former organization for the past fifteen years.

Samuel Kahn, vice-president and general manager of the Western States Gas & Electric Company, has been elected president of the Stockton Chamber of Commerce for the year 1925. Mr. Kahn was chairman of the deep-water committee of the Chamber of Commerce last year.

R. R. Frey, formerly of Indianapolis, has been made sales manager of the Central Iowa Power & Light Company at Waterloo, Iowa. Mr. Frey was merchandise manager for the Merchants' Light & Heat Company in Indianapolis two years, and his Waterloo appointment marks the establishment of a merchandising department there.

William L. Baker, general superintendent of the Waterloo (N. Y.) office of the Empire Gas & Electric Company, has been appointed general manager of that company's properties at Seneca Falls, N. Y., succeeding **B. R. Armitage,** who has been made a special agent for the company at Geneva, N. Y.

W. F. Parker, for the past ten years general sales manager of the Packard Electric Company of Warren, Ohio, has been appointed general manager of the transformer division of the company. Mr. Parker is assuming these new duties in addition to directing the sales of the company. He has been identified with the Packard company since 1912, when he joined its forces as Chicago representative, one year later being transferred to the home office at Warren as general sales manager.

C. Otto von Dannenberg, formerly connected with the electrical division of the engineering department of the J. G. White Engineering Corporation, has affiliated himself with Sanderson & Porter as a member of their field engineering staff at Springdale in charge of engineering design.

George W. Quentin, formerly power sales engineer with the Duquesne Light Company, Pittsburgh, has affiliated himself with the Pittsburgh office of the American Blower Company. During his association with the Duquesne company Mr. Quentin made a special study of steel mills which will be valuable to him in his new connection, where he again will specialize in steel-mill work.

Loyall A. Osborne, president of the Westinghouse Electric International Company, accompanied by Harold Smith, general counsel of the Westinghouse International, recently left San Francisco for Japan to spent a short period of time in the Orient. Mr. Osborne made a statement to the effect that the Imperial Railways of Japan will soon begin electrification of all their lines.

Charles E. Browne of Princeton, N. J., has been appointed chairman of the New Jersey Board of Public Utilities to succeed Harry V. Osborne. The confirmation of Mr. Browne as public utility commissioner followed the rejection by the Legislature of Frederic M. P. Pearse, secretary to Governor Silzer, and the withdrawal of the nomination of ex-Senator Thomas Barber of Phillipsburg.

H. M. Van Gelder has been appointed electrical engineer of the Department of City Transit, Philadelphia, to take charge of the design and to supervise the installation of electrical equipment for the new Broad Street subway system. Up to 1920 Mr. Van Gelder was with Westinghouse, Church, Kerr & Company, holding the positions of electrical and then managing engineer. Since that time he has been engaged on various steam railroad electrification projects, recently on electrification studies for the Canadian Pacific Railway.

Eben F. Putnam, who has been district superintendent in charge of the Connecticut Light & Power Company's gas and electric properties in Norwalk, Conn., has been promoted to be district superintendent of the company's New Britain district. Mr. Putnam has been district superintendent in Norwalk since October, 1919. Prior to that time he was district superintendent at Greenwich, Conn., which position he took after various posts in the new-business and commercial departments of the company at Waterbury, Naugatuck and other points. He first became connected with the company in 1913.

Samuel T. Bodine, president of the United Gas Improvement Company, has been elected a director of the Public Service Corporation of New Jersey to succeed Lewis Lillie. Other directors were re-elected.

H. Hobart Porter, president of the American Water Works & Electric Company, returned to New York April 10 aboard the Cunard liner *Berengaria* after a short sojourn in Europe.

J. R. Henderson has been appointed distribution engineer of the Ohio Public Service Company at Lorain to succeed W. L. Rush, who recently assumed new duties in Jackson, Miss.

S. Murray Jones, formerly connected with the Alabama Power Company, is now in the operating department of the Carolina Power & Light Company at Raleigh, N. C., in the capacity of engineer.

E. H. Ryden, formerly electrical engineer for the Western Electric Company, has recently entered the electrical engineering department of the Utica (N. Y.) Gas & Electric Company.

C. A. Patterson, who has been at Guanajuato, Mexico, with the Central Mexico Light & Power Company for the past year, has returned to the United States to join the Alabama Power Company, Birmingham.

A. G. Carson, who has been manager of power stations of the Wisconsin Public Service Corporation since 1918, has been appointed manager in charge of the electric light, power, electric railway and gas departments of the corporation.

V. P. McNamara, local manager of the Puget Sound Power & Light Company at Edmonds, Wash., has been transferred to Everett. His new position is in connection with the supervision of all the Puget Sound Power & Light Company's suburban offices in Snohomish County.

Forest E. Winterding, who was formerly connected with the Wisconsin-Minnesota Light & Power Company at Eau Claire, has assumed new duties with the Wisconsin Traction, Light, Heat & Power Company at Appleton as chief engineer in charge of all construction work.

Henry S. Newton, formerly manager of the Parkersburg-Marietta division of the Monongahela West Penn Public Service Company, with headquarters in Parkersburg, W. Va., has been placed in charge of the recently organized industrial department. By creating this new industrial department the company is planning to establish contact with all industrial organizations, chambers of commerce, boards of trade and similar organizations in northern West Virginia. Mr. Newton has been affiliated with the Monongahela West Penn company since 1918 and has been in charge of the Parkersburg-Marietta division since 1919.

J. P. Growdon, who was in charge of all design on the Skagit River hydroelectric development of the city of Seattle, has accepted a position with the Aluminum Company of America as principal assistant to James W. Rickey, hydraulic engineer at Pittsburgh. Mr.

Growdon was with the Washington Water Power Company at Spokane for several years, following which he became connected with the Northwestern Electric Company of Portland, Ore. He left his position as superintendent of distribution with that company to enter military service. Following the war he became identified with the Skagit River development, remaining in this employment until the initial project was completed in the fall of 1924.

Obituary

William Rufus Roney of New York City and formerly of Boston died April 6 at the home of his daughter in Downers Grove, Ill. Mr. Roney was for many years identified with the Westinghouse interests and was also a life member of the American Society of Mechanical Engineers.

Arthur Lord, president of the Plymouth (Mass.) Electric Light Company and prominent in Massachusetts legal and historical circles, a fellow of the American Academy of Arts and Sciences and long identified with the Western Union Telegraph Company as counsel, died suddenly at Boston, April 10, at the age of seventy-four.

Milton Sanford Barger, treasurer and assistant secretary of the Rochester Gas & Electric Corporation, died suddenly March 1 aboard the steamship *Berengaria* while en route for Europe on a holiday trip. Mr. Barger had been associated with the New York Central Railroad for many years and at the time of his death was general treasurer. He was born in New York City February 24, 1875, and was a graduate of Harvard University.

John Joseph Redmond, vice-president in charge of sales and a member of the board of directors of the Fulton Iron Works Company, St. Louis, died at Recife, Brazil, April 8, following an illness of two weeks. Mr. Redmond entered the employ of the Fulton Iron Works in 1915. He had been in South America in the interests of the company since last September and was expected to return to St. Louis in a few months. Mr. Redmond was only twenty-nine years of age.

William Edwin Russell, president of the Russell Electric Company, Danbury, Conn., died April 4 of rheumatism. He was sixty-two years of age. Mr. Russell was the inventor of a device for the control of electric motors and was also early in the field in the perfection of electric horns and sirens. A long list of electric patents stands to his credit. He was interested in the X-ray and did much experimental work in this connection.

I. B. Sager, for many years a member of the staffs of the East St. Louis (Ill.) Light & Power Company and the East St. Louis & Suburban Railway, died March 20. Mr. Sager, a pioneer in the East St. Louis territory, built the city's first light and power plant in 1889. When the East St. Louis & Suburban interests bought his power plant he was retained on the staff, remaining up to the time of his death. Mr. Sager was sixty-eight years of age.

J. A. Lighthipe of Los Angeles Dies

James A. Lighthipe, widely known electrical engineer and a former associate of Thomas A. Edison, died in Los Angeles April 10 of pneumonia. Though Mr. Lighthipe was born in Orange, N. J., and received his early training in the East, his chief contributions to electrical engineering were made in the West, where as a specialist in transmission-line construction he had a marked influence on hydro-electric developments.

Mr. Lighthipe, having entered the Edison Laboratory in Menlo Park in 1879, was present when the first successful incandescent lamp was produced there. Mr. Edison sent him abroad in the fall of 1879, and Mr. Lighthipe spent five years engaging in telephone work with the Edison Telephone Company in London, the American Bell Telephone Company in Antwerp, in making insulating material for the British Insulate Company, as an employee of the Edison Company in Paris and later of the German Edison Company in Berlin. After returning to the United States in 1884 he engaged in the installation of Brush arc-lighting sets. Following a brief connection in Trenton, Philadelphia and Wilmington, Del., he was made superintendent of construction of the Edison Consolidated Electric Company, which was merged into the Edison General Electric Company and with the last-named into the General Electric Company. He acted as district engineer for these companies for about eighteen years with headquarters in San Francisco and saw the growth of the incandescent system and the electric railway system and also the beginning of the polyphase system of generation and transmission. It was in 1908 that Mr. Lighthipe affiliated himself with the Southern California Edison Company as chief electrical engineer, the position he occupied at the time of his death. He was a fellow of the American Institute of Electrical Engineers and served as vice-president of that society for two years. Mr. Lighthipe was sixty-eight years of age.

J. A. LIGHTHIPE

James Collins Jones, general counsel for Day & Zimmermann and subsidiaries, died March 14 from double pneumonia after a short illness.

Richard Dix, general superintendent of the Elkhart Railway & Light Company, Ind., was killed on April 5 in an automobile accident near Milwaukee.

Harvey I. Brake, superintendent of the Carlisle (Pa.) Light, Heat & Power Company, died March 30 from a heart attack. Mr. Brake was a native of Edenville, Pa., and was forty-five years of age.

Oscar L. Hyatt, a veteran member of the staff of the Public Service Company of Northern Illinois, died at his home in Chicago Heights, Ill., March 30. Mr. Hyatt was born and educated in St. Louis. He entered the service of the North Shore Electric Company soon after its organization as a member of the Maywood office. In 1905 he was transferred to Chicago Heights, where he was placed in charge of the district, which position he retained up to the time of his death. Mr. Hyatt was fifty-five years of age.

J. H. Van Brunt, formerly manager of the St. Joseph (Mo.) Railway, Light, Heat & Power Company, died March 27 at Kansas City of pneumonia. Mr. Van Brunt retired from the vice-presidency of the St. Joseph utility in 1920 after thirty-one years of continuous service to devote his time to other interests. He had been a prominent figure in utility circles in Missouri, having been elected president of the Missouri Association of Public Utilities in 1918. In recent years he had been operating a radio distributing concern in Kansas City. Mr. Van Brunt was fifty-seven years of age.

Gustavus Ferdinand Bonner, noted British electrical engineer, died March 6 in London, England. Mr. Bonner (formerly Metzger) served his apprenticeship with Gwynne's, Ltd., Hammersmith, and afterward served with the Metropolitan Electric Supply Company. In 1893 he was appointed chief engineer of the Bath electricity undertaking, and in 1901 he became city electrical engineer at Manchester. During the war he changed his name to Bonner and was put in charge of several munition factories. Mr. Bonner was a member of the Institution of Electrical Engineers, the Institution of Mechanical Engineers and the Institution of Civil Engineers.

Gordon Cameron of the Western Machinery Company, Los Angeles, died after an extended illness at the Good Samaritan Hospital in that city on March 10. Mr. Cameron was born at Hamilton, Ontario, in 1884 and was graduated with the degree of B. Sc. in electrical engineering from the Queen's University, Kingston, Ontario, in 1912, when he joined the Canadian Westinghouse Company. He previously had spent a summer in that company's test department and as inspector on high-tension line construction for the Hydro-Electric Power Commission of Ontario. From 1915 to 1916 he taught in the Hamilton Technical School but in 1916 returned to the commercial field as engineer of the oil circuit division of the Condit Electric Manufacturing Company, South Boston, Mass. Following military service he joined the Western Machinery Company in 1923, where he remained up to the time of his death.

Commission Rulings

Cost of Restoring Dam Partly Destroyed by Elements Must Be Amortized.—In evaluating the property of the Southern Nebraska Power Company the Nebraska State Railway Commission did not include the cost of the wrecked portion of a dam which had been in a large measure destroyed by the elements. The loss on the dam must, the commission said, be amortized over a period of time, notwithstanding that the headgates and part of the dam remained intact.

Contract Heating Furnished Through Consumers' Mains Not Public Service.—Dismissing a complaint against the discontinuance of heating service formerly furnished by the Central Illinois Public Service Company, the Illinois Commerce Commission asserted that exhaust heating service furnished under contract through mains paid for and owned by consumers is not public service so as to constitute the electric utility a public utility in so far as the heating business is concerned, especially when the company has refused such service to the public generally.

Length of Conductor Is Not Only Factor in Cost of Rural Operation and Maintenance.—"We do not believe," said the Wisconsin Railroad Commission in approving rural rules and schedules adopted by the Northern States Power Company, "that it follows that the respective costs of operating and maintaining urban and rural distribution systems per customer will be in proportion to the different lengths of conductor involved. There are other factors that enter which make the costs of rural operation exceed the result arising from any such proportion. In the first place, the rural lines are much more exposed to the action of the elements, and the smaller sizes of transformers commonly used on rural lines are especially liable to damage from lightning. Sleet and wind damages are also likely to be much more disastrous to rural lines than to city lines. The distance element also enters into all operating and maintenance work on rural lines, and the idle time of repair and trouble men going and coming is an appreciable item of increased expense, as is also the cost of transportation of men and equipment. With the longer lines and increased equipment per consumer on rural lines the utility is liable for larger renewal charges and taxes per customer or per unit of sales than in the city." Alluding to the losses occurring on rural lines because of the necessity of individual transformers, the commission continued: "It is also true that the line losses chargeable to rural consumers are higher per consumer on rural lines than on urban lines. The latter losses are not, however, so material and are probably offset by the core losses per urban consumer, which are not usually taken into consideration in computations involving a comparison of rural and urban rates. It seems justifiable, however, to charge the entire core losses on rural lines to consumers because of their magnitude. . . . We assume that it is understood by all rural customers that secondary circuits for rural lines do not admit of economical construction. The costs incident to individual transformers and the annual core losses are much less than those arising from the use of secondary circuits."

Surcharge Required from Customers in New District Where Extension Would Yield Only 4 per Cent.—An inquiry made in response to a request from fourteen dwellers in a new district for extension to them of electric service convinced the Connecticut Public Utilities Commission that the Connecticut Light & Power Company would receive only a 4 per cent return on the expenditure involved. The commission therefore refused to order the extension except upon the condition that the residents concerned pay a surcharge to be divided among the contracting patrons of the central-station company and any other patrons who may later desire service on the same terms and who can be served by the same extension.

Recent Court Decisions

Qualifications of an Expert Witness and Valueless Testimony of Non-expert Witness.—In considering the case of the Westinghouse Electric & Manufacturing Company vs. Denver Tramway Company the United States Court for the District of Colorado declared it an error of law to permit a witness to testify as an expert when it was not shown that he possessed any of the qualifications of an expert. The court also decided that evidence introduced by a witness who had none of the qualifications of an expert was valueless in determining property valuation, particularly when this evidence was modified, enlarged and restricted by the personal opinions of the witness.

Costs of Production Not Trade Secrets.—A decision declaring that costs of production are not trade secrets and hence are not entitled to be held in confidence by the Federal Tariff Commission has been handed down by the District of Columbia Court of Appeals in the suit of the Norwegian Nitrogen Products Company against members of the commission. The case grew out of an application under the flexible tariff filed by the American Nitrogen Products Company of Seattle, Wash., for an increase in the duty on sodium nitrite. The application was opposed by the Norwegian Nitrogen Products Company, representing producers of this chemical in Norway. The commission held that costs of production of individual companies were trade secrets and that under the organic act of the commission of 1916, which it contended was carried forward into the flexible tariff, trade secrets must be treated as confidential when given to the commission. The Norwegian company sued for a writ of mandamus to compel disclosure of the information. The District of Columbia Supreme Court sustained a demurrer filed by the commission and dismissed the petition. An appeal was filed, and in the meanwhile the President acted on the commission's report and increased the duty on sodium nitrite. Because the President had issued his proclamation the Court of Appeals affirmed the lower court in the case, but its opinion sets forth that costs of production are not trade secrets, that in denying access to them the commission deprived the Norwegian company of its rights to prepare an adequate defense in the case, and also that cross-examination of agents of the commission should have been permitted.

Maintenance of Lines by Man on Part Time at Irregular Intervals Not "Casual Employment."—The case of Pfister vs. Doon Electric Company, before the Supreme Court of Iowa, involved a definition of casual employment. Pfister was a lineman employed by the telephone company, but also did all the line maintenance for the Doon Electric Company. Since the town and company were small, this work took only a few hours each month at irregular intervals. While working on the electric company's lines he was killed, and it was the company's contention that he was only casually employed and that it was not liable under the workmen's compensation act. The court defined casual employment as employment that is irregular and does not involve the hazards and dangers incident to the employer's business. Since the appellant was engaged in specialized work which involved the hazards of the defendant's business and had done this work intermittently for some time, the Supreme Court affirmed the judgment of the lower court awarding damages. (202 N. W. 371.)*

Doctrine that the Care Required in Operating Electric Plant Is "Measured by the Hazard" Not Upheld.—In Scott vs. Town of Oxford the Appellate Court of Indiana upheld the trial court in awarding damages for the death of a man who, as alleged, was killed through the contact of the town's sagging high-voltage wires with the secondary system supplying his garage. The reviewing court held that the town's negligence in the maintenance of its wires was sufficiently established to make it unnecessary to invoke the doctrine of *res ipsa loquitur* (the thing speaks for itself), though this principle was entirely applicable. To an instruction by the trial judge that the care required of a municipality in maintaining and operating an electric lighting plant is "measured by the hazard and danger of the enterprise," the Appellate Court, however, demurred, pointing out that it had been "repeatedly held by this court and by the Supreme Court that ordinary care under the circumstances of the case is the only kind of care which is required." The "unfortunate expression" did not, however, constitute a reversible error in the case under review. (146 N. E. 833.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Manufacturing and Markets

Eliminate Waste by Collective Effort

Hoover, Swope and Green Discuss Opportunities to Accomplish This and the Minimizing of Industrial Controversy at "Industrial Round Table" of National Civic Federation

WASTE elimination and the minimizing of industrial controversy were discussed from the sides of employer, employee and the public at the first "industrial round table" of the National Civic Federation, held in New York on April 11. Herbert Hoover, Secretary of Commerce, and Gerard Swope, president of the General Electric Company, in striking phrase, gave the viewpoints of the public and of the employer respectively, while William Green, president of the American Federation of Labor, made a comprehensive and dramatic pronouncement regarding the attitude of labor toward industrial controversy and waste elimination. The "round table," presided over by Judge Alton B. Parker, president of the federation, is the first to be held under authority of a resolution passed at the recent memorial meeting in honor of August Belmont and Samuel Gompers, two of the early and stanch supporters of the federation.

Problems of Mutual Interest

Mr. Hoover's text was that the greatest opportunity for increased wages and higher standards of living for the worker lay in eliminating industrial wastes. These wastes can be reduced only by collective effort. "They contain," he declared, "the paradox that if we save collectively, we shall have more goods and services to expend individually." Illustrating the possibilities, he commented on the fine showing of our railways in the last three years. They have handled a 14 per cent increase in gross operating expenses. Rates have been decreased over 5 per cent, the hours of the workers have decreased and the wage has increased slightly. Service to the community has been immeasurably improved, and all this owing to great effort in management and the co-operation of the employees and of the community itself. He cited also the waste elimination efforts under way in the construction industry as typical of effective collective effort.

Mr. Hoover declared that there is hope that America is finding a solution of the problem of attaining social satisfaction with the preservation of private industry, of initiative and full development of the individual. This is being brought about by recognition of the identity of interest of employer and employed and the effort to organize that identity in order to limit the area of conflict. Elimination of waste is one of the subjects in which there is identity of interest.

He also spoke in part as follows: "Perhaps dimly, but with no less certainty, there is looming up in the American industrial world a definitely new relationship in the whole setting of industry. The ownership of utilities and large manufacture has to a great degree been divorced from management. The capital ownership of great service and production is rapidly being diffused over millions of individuals, none able to dictate management. The managers of older and settled industry are today rising out of the skill of the industry itself, and they are gradually coming into a new vision of relationships. That relationship is one of a tripartite responsibility to the consumer on one hand, to the worker on another, and a regard for capital only to the extent that it shall be commanded on the best possible terms for the expansion and conduct of the industry. The savings we can make through application of invention, through increase in skill, through elimination of collective waste, are bound to be divided over the consumer to attract business, divided over labor to secure service and contentment, more than over capital, because capital becomes cheaper with increasing security."

Making the Employee Think

Mr. Swope maintained that waste elimination can be greatly furthered if the thought of the workers can be directed to the subject. He related that in an organization of 60,000 workers, 8,000 suggestions were received in 1923 and 10,000 in 1924. Of these 5,000 had been put in practice, and $100,000 had been paid, over and above wages, to the workers who had made the suggestions. He stood, he declared, for lower selling prices of commodities and showed that lower prices are not incompatible with higher wages. Incandescent lamps, for example, are now cheaper than they were before the war, yet the earnings of the workers have increased 100 per cent. The "labor content" of each lamp, however, has been decreased. This has been brought about by more efficient methods.

Commenting on selling prices, Mr. Swope added: "We have a great advantage in America in having a large population becoming constantly more homogeneous, speaking at all events one language, existing under the same political institutions, having common ideals and with a high standard of living. This makes it possible to market a standard product, bringing in its train the advantages of quantity production, in which field the manufacturing companies throughout the United States have taken the lead.

"The problem still before us is to reduce selling prices so as constantly to reach a larger and larger circle of buyers, and this means not only advancement in manufacturing processes but also reduction in cost so as to enable us to distribute our product at a lower selling price. Reductions in cost do not necessarily mean increased profits to the manufacturer; they may to a certain extent, but lower costs must sooner or later always be reflected in lower selling prices. Not only is this a fact as gained from experience, but it will be seen that this is very desirable from the standpoint of the manufacturer, as the market is thereby enlarged, with the possibility of still further reducing the manufacturing and distributing costs."

Workers' Suggestions Valuable

Mr. Swope closed his remarks with a discussion of the larger value of workers' suggestions and of the relations between management and employee. "The effect upon the organization of these suggestions by workmen," he said, " is of even greater importance than the reduction in cost and the monetary rewards to the men, because of the stimulation to the men themselves and to the *esprit de corps* of the organization as a whole, owing to the recognition that the working man is a live, integral part of the business and may contribute to a greater extent than he has heretofore in its upbuilding. This gives the workingman a greater interest in and keener sense of enjoyment from his work, as he feels that he has made a constructive contribution. The recognition that has come to him is not only appreciated but causes him to be respected by his associates.

"This also often leads to finding talent and ability for bigger jobs. This is one of the most difficult and elusive parts of the problem of management—finding the exceptional man. It is a very widespread problem but pressing in any large industrial organization. The problem of knowing and rating the men, and giving them opportunities to do bigger jobs, is essentially a job for management. But probably the most tragic waste of all in industry is unemployment, where men ready and willing and able to work are unable to secure it, and where society really needs their work. The most severe test of any social system is the consideration it gives to the human being, and our present system must find a solution of this great human problem.

"Industry also is much more cordial today than ever before toward the problem involved in minimizing industrial controversy. It is recognized that if you have the sympathy and understanding of the workmen, the *esprit de corps* of an organization will be much better, work will go more smoothly, the material results accomplished will be greater, and the human satisfaction to all concerned will be vastly increased.

"As business is organized today most companies have a large number of shareholders to whom they report periodically as to the results of operations, and there is every reason why the workingmen should be kept informed of the development of the business so that they also can see whither it is tending. This has been accomplished in many instances with marked success by having the representatives of the men meet with the management for the purpose of discussing various problems as they arise, so that the men will have a general understanding as to the business of the company. One of the gratifying results has been the increased satisfaction on the part of the workingmen and the largely decreased turnover of labor partly because of this. There is still much to be done, and the most hopeful aspect of the problem is that management and men are approaching it in a more open-minded manner."

ATTITUDE OF LABOR

Mr. Green declared at the outset that labor believes that production costs should be lowered through the promotion of efficiency in workmanship and management, the elimination of waste and the introduction of economy processes. Unreasonable competition is one of the primary causes of waste, leading even to a disregard of human life and human welfare. He cited a great basic industry (admitting after his address that it was the bituminous coal-mining industry) in which, as the result of competition, there is at present shocking disorganization and human suffering. "Since labor organizations cannot be destroyed, why not," he pleaded, "recognize their value and merit and accept from them the benefits they can give through their organized effort?"

The workers realize that their welfare in a great measure depends upon the maintenance of peace in industry. They have believed that it could better be maintained through collective bargaining. He insisted that efforts of employers to prevent the organization of workers are a waste of time, money and effort that should be eliminated. "Labor," he declared dramatically, "is not un-American. It is sound, constructive, practical and rational. It has been forced to take a militant attitude in order to maintain its very existence. It does not want to waste its energies in industrial conflicts. It understands fully the cost of industrial strife, but it is determined to assert its right to organize and bargain collectively, regardless of cost or sacrifice.

"I am confident that we can minimize industrial controversy through a proper regard and recognition of the rights of both employers and employees. The right of the employer to manage his industry, to control it and to receive a fair profit upon his investment should be maintained and recognized. The right of the employees to organize, to bargain collectively, to be represented in conference with employers through their chosen representatives, is a right which should be readily accorded and completely recognized. A religious observance of these rights will do more to minimize industrial controversy than the application of any rule or formula.

"Supplementing the recognition of these simple rights must come understanding, co-operation and the manifestation of a mutuality of interest in the management and conduct of industry. Good faith and good will must be firmly established. Perfect candor must characterize the attitude and relationship of both employers and employees at all times.

"Labor organizations have succeeded in many lines of industry in establishing such business relationships between employers and employees and thus reducing the cause of industrial controversies. Organized labor is deeply interested in the proposal to eliminate industrial waste and has succeeded in bringing this about in a very large measure where it has had a proper opportunity to function. It seeks for the opportunity to do more effective work. It can, if given this opportunity, provide the machinery through which industrial controversies may be lessened and substantial help can be given in the task of eliminating waste and inefficiency."

Reasons Which Led to Merchandising Concentration

Interview with General Manager J. S. Tritle of the Westinghouse Company Elicits Two Interesting Forecasts of Trends—Outlook Most Promising

TWO interesting forecasts of trends in the merchandising of electrical appliances and accessories have been underlying influences in the reorganization of the merchandising department of the Westinghouse Electric & Manufacturing Company, which was announced for next week. Since the establishment of this department in 1922 to combine under one sales management Westinghouse ranges, domestic heating appliances, fans, battery chargers, farm-lighting plants, safety switches, panelboards, fuses, lighting equipment and kindred lines, sales headquarters have been maintained in New York, with engineering departments in East Pittsburgh and production principally at the Westinghouse works in Mansfield, Ohio. With the seven-hundred-and-fifty-thousand-dollar addition to the Mansfield factory nearing completion, the entire operation of production, engineering, sales and advertising has been concentrated at Mansfield under J. S. Tritle as general manager of the department. This concentration is in direct preparation for the very large increase in business which the coming years are expected to bring in the electrical merchandise field.

DEALER NEEDS STRONG LINE

"There is a distinct trend," Mr. Tritle said to a representative of the ELECTRICAL WORLD, "toward the development of a more stable business for the electrical dealer. The hardware store today can count on a steady business year by year from every household to which it sells. It does not vary greatly because every family buys annually about so much in paint, nails and tools and so on. The electrical store, be it the shop of a central-station company or a dealer, is gradually getting into the same kind of a relationship with the household. The dealer is therefore destined to become more and more a neighborhood store and headquarters for electrical household appliances and supplies. The strength of the dealer in his local market will depend to a considerable extent on the prestige of the line he sells, as established by quality plus national and local publicity. We believe, therefore, that it will be distinctly to the advantage of the dealer to have as extensive a line as possible, concentrated under one widely known name and supported by a well-balanced promotion program and a unified service."

AUTOMATIC CONTROL COMING

Mr. Tritle also believes that automatic heat control in domestic appliances is to be an important factor in the future and is in fact fast developing. "The public is steadily demanding higher degrees of safety," he said. "Four-wheel brakes, traffic signals, safety switches are all reflections of this. Ranges, flatirons and percolators with automatic thermostat control that renders them not only more convenient but absolutely safe are growing in popularity, and I believe this safeguard will be gradually applied to all other appliances where a thermostat will bring a practical improvement. The American people are looking at fire hazards more frankly today, and were it appreciated, for instance, that the recent burning of a large building was caused by the careless use of an electrical appliance, which it is reputed was the case, and that this great property loss and life hazard would have been prevented if the heat in that appliance had been automatically controlled, the demand for automatic appliances would be more than any manufacturer could satisfy at the present time. The public does not understand this and should not be unnecessarily alarmed, but the demand for automatic control will inevitably grow and become standard."

CENTRAL-STATION SELLING IMPROVES

The extent of the Westinghouse merchandise line and the attention which the company has been giving to automatic control promise, in the judgment of the Westinghouse officials, a very large development in business, and the department is simply getting ready. Mr. Tritle expressed the opinion that there will be a constantly increasing expansion of central-station merchandising, but that with this will come a growing appreciation of the dealer's usefulness in the local market, and the dealer will, in consequence, find increasing opportunity to prosper and serve the electrical industry and the local public. The range business, he says,

is showing marked improvement over the last six months, particularly in the Southeastern States. The fan outlook is particularly bright, and the central station has become a dependable fan dealer, which proves, in Mr. Tritle's opinion, that increasing stability in the line will tend to bring better merchandising practices into central-station selling.

The Westinghouse merchandising department has increased its sales in the last three years 50 per cent and again 50 per cent and then 12 per cent over the year previous, and is now doing an annual business of $15,000,000. It has become the second largest manufacturer of farm-lighting plants.

Manufacturers Aid War Department Program

The War Department's program for the mobilization of industry for national defense is rapidly taking shape, under the guidance of an ordinance advisory board of manufacturers, of which Judge E. H. Gary, chairman of the board of the United States Steel Corporation, is chairman and General Guy E. Tripp, chairman of the board of the Westinghouse Electric & Manufacturing Company, is a member. Details of the program were announced at a meeting in New York last week, embodying the placing in time of peace of tentative orders with selected manufacturers for the production of various types of munitions, effective in the event of an emergency. A large number of prominent manufacturers are co-operating in the program.

General Tripp in commenting on the plan said:

"This getting together of the War Department and manufacturers makes possible the doing of good work for the nation under the best possible conditions, instead of forcing the turning out of bad work under the worst possible conditions. Especially it eliminates, as far as such a thing can be done, the fly-by-night manufacturers who upset markets, cornered supplies, pre-empted labor, clogged transportation, did poor work and were the real profiteers during the late war."

Business Conditions

SEVERAL electrical manufacturers have reported sales during the first three months of this year as equal to or better than those in the same period last year. The General Electric Company has announced its sales for that period as 14 per cent better than last year. The Kelvinator Corporation has reported its gross sales for that period as $900,000, with orders during March 500 per cent greater than in March, 1924. Reports from other electric refrigerator manufacturers show a similar trend.

There is no question that the electrical business is in good shape and sales are holding up well. There are no particularly large inquiries, but many orders are being received. A manufacturer of switching equipment reports the receipt of an order for 132-kv. apparatus for eleven substations from two central-station companies and states that he is busy on a good volume of unfilled orders.

The United States Steel Corporation reported a decrease of 421,207 tons last week in the volume of unfilled orders on hand at the close of business on March 31 from the previous month. This is the first decrease since July 31 last. Steel leaders have confidence in the immediate future of the industry and believe this decrease in unfilled orders to be owing to more frequent orders in smaller quantities and to the tendency not to place heavy future orders.

In New England the chief interest has been shown in household appliances and wiring supplies, though other material is in fair demand in spite of the depression in the textile and leather-working centers. Business in New York showed little change, but more inquires were made by central-station companies. The Middle West reports that business transacted in the first two weeks of April showed an increase over the same period in March, and the industry seems to feel that the remainder of the month will be much better. Utility companies in this section are now busy with construction and maintenance work which will necessitate a growing volume of purchases. Business in the Southeast continues active with prospects of greater buying of electrical material by the textile industry in the future. All classes of material were included in business transacted, with unusually good sales of fans and vacuum cleaners. The Pacific Coast was still quiet, but more inquiries and an unprecedented building program in certain sections indicate increasing business soon.

Building Operations in March at a High Figure

MARCH building operations showed an increase of 11 per cent over the corresponding month of last year, according to the F. W. Dodge Corporation. Building contracts awarded last month in the thirty-six Eastern states (which include about seven-eighths of the total construction volume of the country) amounted to $480,916,300, compared with $433,340,300 in March, 1924. The increase over February of this year was 61 per cent.

Public works and utilities projects continue to increase. Last month they amounted to $67,931,000, or 14 per cent of the total. Educational buildings, amounting to $42,192,900, or 9 per cent of the total, also increased over last March. Residential buildings, although amounting to 46 per cent of last month's total, or $220,872,100, fell behind the previous March, and commercial buildings fell behind, too, amounting to $54,871,100, or 11 per cent of the total.

Total construction started during the first quarter of this year has amounted to $1,076,569,300, an increase of 4 per cent over the first quarter of last year. The New York State and northern New Jersey territory has shown a decrease of 32 per cent, the Northwestern States a decrease of 8 per cent; all the other districts show substantial increases. In fact, the territory outside of New York City shows a general increase of 21 per cent over the first quarter of 1924. Contemplated new work reported in March amounted to $770,301,800, which was a considerable increase over the previous month and also over the previous March.

Electric Furnace Manufacturer Reports Fine Business

EXTREMELY active business, combined with a tendency toward longer deliveries of electric furnaces and a volume of sales running far ahead of last year, is reported by the American Metallurgical Corporation, Boston. To a representative of the ELECTRICAL WORLD President K. A. Juthe stated a few days ago that in the last two months proposals exceeding $150,000 have been sent out in response to inquiries, and the factory is now so busy that deliveries are being quoted on a three months basis, even on smaller units. In Mr. Juthe's opinion, "the outlook for this year is splendid, and so many new applications of industrial electric heating are coming along that it is difficult to forecast the scope of this development over a stated period. Recent improved applications include the heating of tempering oil, air heating under pressure for process work, eliminating wood in certain cases of brass annealing, and mercury-reclaiming development in the brass industry —a promising line of investigation."

Link-Belt Reduces Prices of Portable Loaders

THE Link-Belt Company, Chicago, has announced a price reduction on its type C portable bucket loader and the "Cub" portable belt conveyor. These machines complete with two-phase or three-phase, 60-cycle alternating-current motor are now reduced to $475 f.o.b. Chicago or Philadelphia. The company announces that quantity production has resulted in considerable saving in manufacturing cost and has made possible this reduction in price.

Metal Market Dull with New Low Levels

THE copper market has been exceedingly dull, as have zinc and tin, while the amount of activity in lead has been nothing noteworthy. Prices of these metals have again worked to lower levels with consumers generally buying only because of strict necessity. Underlying conditions in the United

NEW YORK METAL MARKET PRICES

	April 8, 1925 Cents per Pound	April 15, 1925 Cents per Pound
Copper, electrolytic	13.55–13⅝	13⅜
Lead, Am. S. & R. price	8¼	8¼
Antimony	13¾	13
Nickel, ingot	31	31
Zinc, spot	7⅛	7.30–7.35
Tin, Straits	51⅛	50½
Aluminum, 98 to 99 per cent	28	27

Base copper price April 15, 1925, 16 cents.

Value of Electrical Exports for February, 1925, Compared with Corresponding Month in 1924

(Issued by Bureau of Foreign and Domestic Commerce)

	February 1924	February 1925
Generators:		
Direct-current:		
Under 500 kw.	$77,453	$45,973
500 kw. and over	13,714	45,195
Alternating-current:		
Under 2000 kva.	19,125	2,830
2,000 kva. and over	161,012	3,050
Steam turoine-generator sets	784	21,390
Accessories and parts for generators	58,930	60,991
Self-contained lighting outfits	54,850	64,586
Batteries:		
Flashlight	58,595	77,570
Other primary	62,564	50,257
Storage	240,090	161,047
Transforming or converting apparatus:		
Power transformers	214,342	136,113
Other transformers	263,071	90,076
Rectifiers, double-current and motor-generators, dynamotors, synchronous, and other converters	74,448	66,317
Transmission and distributing apparatus:		
Switchboard panels, except telephone	113,954	40,597
Switches and circuit breakers over 10 amp.	118,323	121,853
Fuse and fuse blocks	30,223	18,855
Watt-hour and other measuring meters	91,493	19,646
Volt, watt and ampere meters and other recording, indicating and testing apparatus	103,462	74,506
Lightning arresters, choke coils, reactors and other protective devices	80,784	34,611
Motors, starters and controllers:		
Motors, under 1 hp.	133,846	96,080
Stationary motors:		
1 to 200 hp.	271,043	157,107
Over 200 hp.	37,210	5,211
Railway motors	136,011	150,573
Electric locomotives:		
Railway	.....	.....
Mining and industrial	47,350	7,563
Starting and controlling equipment for:		
Industrial motors	123,183	51,496
Electric railway and vehicle motors	23,157	82,532
Accessories and parts for motors	162,832	86,480
Electric fans	166,880	44,295
Electric lamps:		
Metal-filament	75,020	84,986
Other electric lamps	35,774	15,386
Flashlights	53,945	63,614
Searchlights and projectors	40,155	23,035
Motor-driven household devices	$72,091	$87,234
Domestic heating and cooking devices	84,521	92,030
Industrial electric furnaces and ovens	13,552	6,779
Therapeutic apparatus, X-ray machines, galvanic and faradic batteries, etc.	90,383	92,118
Signal and communication devices:		
Radio apparatus	302,121	477,591
Telegraphic apparatus	73,551	31,294
Telephone apparatus:		
Magneto telephones	6,566	5,619
Other telephones	83,218	44,205
Telephone switchboards	93,292	3,264
Other telephone equipment	141,615	227,750
Railway signals, switches and attachments	193,510	34,107
Bells, buzzers, annunciators and alarms	8,945	10,853
Other electric apparatus:		
Spark plugs, magnetos and other ignition apparatus	178,175	153,266
Insulating material	187,701	100,982
Metal conduit, outlet and switch boxes	54,121	47,328
Sockets, receptacles and lighting switches	92,469	105,891
Electric lighting fixtures, interior and street	68,832	67,504
Other mining supplies and line material	89,750	82,946
Other electrical apparatus not elsewhere specified	720,416	447,441
Globes and shades for lighting fixtures	26,710	32,675
Electrical glassware, except for lighting	28,273	17,182
Electrical porcelain	158,061	†
For less than 6,600 volts	*	80,812
For 6,600 volts and over	*	22,743
Electrical carbons, carbon brushes and electrodes	213,576	†
Electrodes for electric furnaces	*	111,260
Other carbon products	*	127,729
Insulated wire and cable (iron and steel	50,890	17,979
Other manufactures of aluminum	56,725	40,203
Copper, bare wire	130,771	181,362
Copper, insulated wire and cables	463,234	305,468
Total electrical machinery and apparatus and supplies	$6,826,792	$5,039,436

* Not separately stated prior to Jan. 1, 1925.
† Discontinued beginning Jan. 1, 1925.

States seem to be splendid, and it is the general opinion that with a little more confidence displayed by producers, consumers and manufacturers in the future of business the situation would soon right itself. An improvement in the political conditions abroad would also help.

Copper manufacturers report that orders are reaching them regularly from diversified industries for small tonnages. Large quantities of lead have been sold at the present low prices, and it is predicted that there will be a scramble to obtain it if the price should rise, for consumers will try to buy a little ahead and producers will be willing to let more of their production go into their stock piles.

All Branches of Business Are Active in Southeast

BUSINESS throughout the Southeast shows little change from that of several weeks past. Activities in the Birmingham district and all sections of Florida continue brisk. A potential activity is to be noted around Savannah, and this will doubtless develop into actual business when the new port rates and coastal highways make themselves felt. Central-station purchases continue satisfactory, particularly in line materials, the orders covering practically all classes of line and construction materials. Conduit is in very active demand. Orders are being received in reasonable volume from the iron and steel industry, with prospects for a material increase in this line by midsummer, but the orders from textile interests have not come up to estimates made earlier in the year. However, more activity in the textile purchases of electrical materials should be witnessed within the next sixty days.

Steam railroads are purchasing in reasonably good volume, one of the largest Atlanta jobbers reporting the receipt of one large order last week for train-dispatching equipment. The industrial demand generally is slightly off, but orders from small contractors are on the increase. Construction started in nine Southeastern states in March amounted to $50,503,400, an increase of 8 per cent over February and of 8 per cent over March, 1924.

Fans have begun to move in satisfactory volume in Florida, and all jobbers in the territory are heavily stocked in anticipation of a splendid season for this specialty. Vacuum-cleaner sales are increasing in the territory generally, one manufacturer's representative stating that his company sold approximately 700 cleaners in March.

Sales in the New York District Are Holding Up Well

MANY manufacturers report sales in the New York district as holding up well and equal to those for the same period last year or better. A motor manufacturer states that his business consists of many small orders, but it is ahead of that transacted a year ago and from all indications is continuing that way. Steady sales of general supplies were made during the week, and one company reports the sale of $75,000 worth of wire to an elevator manufacturer.

Central-station companies are placing many small orders for high-tension switching equipment and are steadily purchasing transformers, switchboards, watt-hour meters and similar equipment. There are no particularly large inquiries being received from any individuals. Many orders are being placed by holding companies for apparatus to be used in the development of new properties recently acquired. Sales by jobbers are in small lots, with competition keen for whatever few large orders enter the market.

April Business Shows Gain Over March in Middle West

BUSINESS in general remains good, although somewhat spotty. The volume transacted in the first two weeks of April shows an increase over the same two weeks in March and indications point to a very favorable month. The utility companies are busy with construction work, and maintenance purchases play an important part in general business conditions. Among the interesting orders that were placed this week was one for 60,000 watt-hour meters.

Jobbers report good sales. While the volume of business is not all that could be desired, it is universally felt that business in general is good. Appliance sales have been good, with washing machines leading. One manufacturer of electric washers recently received a single order for 200 machines.

Domestic Equipment Selling Well in New England

DOMESTIC equipment has sold well in New England during the past week. This is particularly true of small refrigerating units and electric ranges, with a good volume of sales in smaller household appliances. One group of fourteen central stations reports an encouraging interest in flatirons, portable lamps, small kitchen units and cleaners. The total sales of all appliances of this group for the week amounted to $14,694, and for the period to date in 1925 they were $171,493.

Although the jobbing business shows no striking gains, nevertheless a fair movement in electrical supplies is reported throughout the district. One jobber records the sale of nine cars of fiber conduit and one car of pole-line hardware. Another reports two sales of power apparatus and supplies to

local mills. In general, the sale of small motors continues to slacken, owing in part to a depression in business among mills and factories throughout the textile and leather-working centers.

Wiring contracts show an encouraging trend, and many inquiries and negotiations are under way for wire and lighting fixtures. Industrial electric furnaces continue to be in strong demand, and there is good activity in switches and control apparatus.

The uncertainty which has surrounded the labor situation in Boston for the past few weeks has cleared up as the result of a settlement of the wage issue.

Outlook Bright on Pacific Coast —Business Still Quiet

ALTHOUGH business is still rather quiet on the Pacific Coast, there are exceedingly hopeful signs for the near future. Orders from country dealers and contractors are in small quantities but are well assorted, with fairly large orders for socket parts, magnetic switches and strain insulators. In the Seattle district building is progressing at an unprecedented rate, the weekly building permits issued running more than twice normal for this time of year. This building provides electrical work in abundance with good prices, and, in addition, collections are reported good.

There are many inquiries coming in from railroad companies and power companies for material. A yearly contract for 10,000 lb. of friction tape for one railroad is now pending, and one power-company inquiry covered five carloads of fiber conduit, seventy-five carloads of cross-arms and $15,000 worth of poles. The power companies hold a surplus of poles from last year, which will cut sales somewhat, but many lateral distributing lines are planned in the interior valleys.

A state bid now being awarded covers 25,000 ft. of conduit, 100,000 ft. of rubber-covered wire and other items in proportion. Small tools are beginning to be in demand, an order from one power company calling for 100 pairs of 7-in. and 8-in. pliers. Corresponding inquiries from other companies are also reported.

Activities of the Trade

General Electric Orders for First Quarter Increase

Orders received by the General Electric Company for the three months ended March 31, 1925, amounted to $83,846,236, and compare with $73,487,903 in the same quarter of 1924, according to an announcement by Gerard Swope, president. This represents an increase of 14 per cent. Orders received by the company during the quarter ended December 31, 1924, were $80,009,978.

Kelvinator Corporation Orders Show Large Increase

Gross sales of the Kelvinator Corporation, Detroit, for the first quarter of the year were announced as $900,000. Unfilled orders on the books of the company on March 31 show an increase of more than forty times those of a year ago. Shipments during March were 250 per cent greater and orders 500 per cent greater than in March, 1924.

Lighting Fixture Manufacturers to Hold Convention in June

The National Council of Lighting Fixture Manufacturers will hold a joint convention with the National Association of Lighting Equipment Dealers, the Illuminating Glassware Guild and the Associated Lighting Equipment Salesmen of America at the Ambassador, Atlantic City, June 17 to 19. Herman Plaut, 432 East Twenty-third Street, New York, president of the National Council of Lighting Fixture Manufacturers, is in charge of arrangements. Other officials of that organization are: D. C. Delancey, vice-president; H. B. Garrett, secretary; Charles H. Hofrichter, honorary secretary, and B. F. Klein, treasurer. E. R. Gillett of Toledo is president of the National Association of Lighting Equipment Dealers.

National Electrical Instrument Under New Management

Warren W. Scott, Inc., 110 Broad Street, Boston, has taken over the management of the National Electrical Instrument Company, formerly of 162 Sidney Street, Cambridge, Mass. The establishment has been transferred to the Broad Street address, where a 25 per cent increase in floor space is being utilized. The company repairs, maintains and calibrates electrical instruments of all kinds and will soon engage in the manufacture of oil burners. Warren W. Scott is general manager.

General Electric Company Wins Lamp Monopoly Suit

In a letter to its stockholders, signed by Owen D. Young, chairman, and Gerard Swope, president, the General Electric Company states that the suit brought against the company based upon charges made before the Lockwood committee in 1921 that it was maintaining an unlawful monopoly in the manufacture of tungsten-filament incandescent lamps and that its sales methods were illegal has been dismissed in the United States District Court of Ohio.

In January, 1922, the General Electric Company wrote to the Attorney-General of the United States denying these charges, pointing out that if the charges were true the company was a violator of the federal laws and inviting the Department of Justice to investigate the charges, and if the conclusion was reached that any of the acts of the company were of doubtful validity, to bring an appropriate proceeding in the courts in order that the matter might be determined.

Thereafter the Department of Justice made a thorough and detailed examination of the lamp business of the General Electric Company and, in February, 1924, brought a suit in the United States District Court in Cleveland against the General Electric and also the Westinghouse company, which was operating under licenses granted to it under patents of the General Electric Company. On April 3 last the court decided in favor of the defendants, as reported in the ELECTRICAL WORLD of April 11, and found for the company on every point.

The Dubilier Condenser & Radio Corporation is now moving to its new factory at 238th Street and Bronx Boulevard, New York. This factory provides facilities for tripling present capacity.

The Pittsburgh Electric Furnace Corporation announces that since April 1 its offices and shops have been at the foot of Thirty-second Street and Putney Way, Pittsburgh.

The Wetmore-Savage Company, jobber, 76 Pearl Street, Boston, has acquired the business of the Foster-McDonald Company, also an electrical supply jobber, 176 Congress Street, Boston. The purchasing company will retain the personnel of the other concern.

Fairbanks, Morse & Company, Chicago, manufacturers of electrical machinery, oil engines and pumps, have appointed E. M. Clapp as manager of the textile division of its office in Charlotte, N. C. Mr. Clapp was formerly textile specialist for the Atlanta office of the General Electric Company.

The Wayne Tank & Pump Company, Fort Wayne, Ind., announces that after a number of years of research work and experimentation it has placed in production the Wayne oil burner for domestic use. The burner is made in three sizes to adapt it to a wide range of heating requirements. Hundreds of Wayne burners are said to have been in active service for four years.

The Splitdorf Electrical Company, Newark, N. J., manufacturer of automotive ignition devices and radio equipment, has entered suit against the Dubilier Condenser & Radio Corporation, New York, for infringement of a patent known as Van Deventer patent 1,181,623, issued May 2, 1916. This patent covers broadly the ordinary fixed mica condenser as at present used in radio sets.

The P. A. Geier Company, 540 East 105th Street, Cleveland, announces that it is now placing on the market its new model K "Super-Royal" vacuum cleaner, including such features as a new-type dust bag, a new cord ("Rome Super-Service"), a more powerful motor and a 15-in.-wide cleaning nozzle.

The Electric Storage Battery Company, Nineteenth Street and Allegheny Avenue, Philadelphia, awarded a contract for its proposed new plant addition at Adams Street and Rising Sun Avenue and will proceed with the work immediately. It will be 80 ft. x 245 ft. and is estimated to cost about $80,000.

New Equipment Available

Suspension-Type Insulator

A new design of the Hewlett insulator, known as the Locke Hewlett, type 9140, and adapted for any and all service where a suspension-type insulator is required, has been placed on the market by the Locke Insulator Corporation, Baltimore. The improvements depend almost entirely upon a new method of fabrication which enables the insulator to be made with rectangular holes. This construction permits the use of flat connecting links and gives a larger bearing surface between links and porcelain, which makes possible a higher total but lower unit stress of the porcelain.

The shape of the insulator has also been improved, providing for more effective washing and improving its electrical characteristics. In assembling 9,140 units in strings the spacing is 5¾ in. This spacing gives the maximum flashover values without cascading, and also when the units are wet it results in maximum protection from the drip of water from unit to unit. The mechanical strength of the insulator complete with hardware is 10,000 lb. At commercial frequencies the ratio of puncture to flashover is at least one and one-half to one.

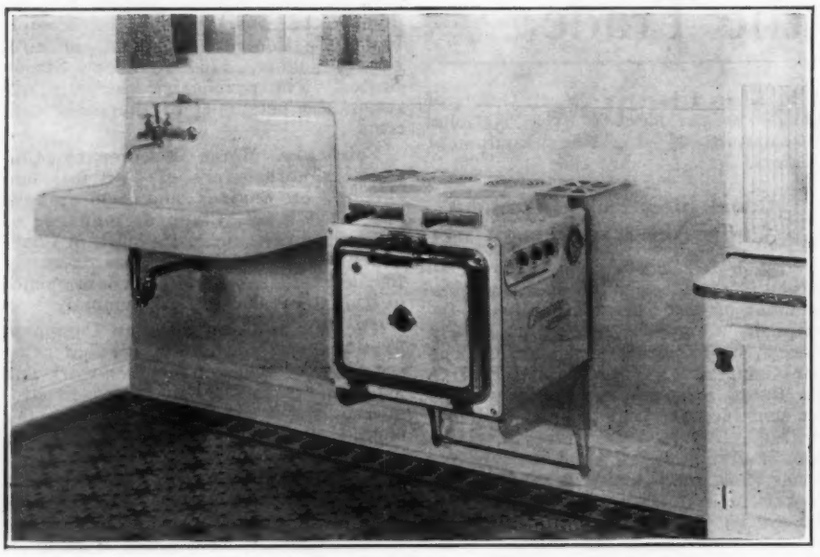
Laboratory Potentiometer

A laboratory potentiometer known as the "Model A" has been placed on the market by James G. Biddle, 1211 Arch Street, Philadelphia. There are three main operating dials in the potentiometer circuit, the third of which consists of a single turn of slide wire, thus permitting rapid manipulation. The dial positions as well as all other adjustments are in full view looking down on the instrument from in front of it.

The normal range of the potentiometer is from zero to 2.11100 volts by indicated steps of 0.00005 volt, easily readable to one-fifth of a division. In operation 0.01 amp. is required through a total measuring resistance of 211.10 ohms. A small galvanometer is included in the instrument for making measurements of moderate accuracy, but an external galvanometer of higher sensitivity can readily be placed in the circuit if desired. Standard-cell voltage compensation is provided, as well as battery rheostat, galvanometer tap keys and double-pole change-over switch for checking the potentiometer current against the standard cell.

Automatic Electric Range

The Armstrong automatic electric range, which is built very compactly and is fastened to the wall by means of a bracket, not being provided with legs, has been placed on the market by the Armstrong Manufacturing Company, Huntington, W. Va. The range is finished in pure white enamel and polished nickel throughout, is well insulated and provided with a full-automatic oven control.



ARMSTRONG AUTOMATIC ELECTRIC RANGE MOUNTED ON WALL. (NOTE CLOSED ELEMENTS WITH WAFFLE MOLD AND TOASTER DRAWER)

All heating elements can be replaced as easily as electric light bulbs without the use of tools or exposing wiring. The oven can be removed by loosening two screws. In fact, the entire range can be taken apart and assembled with the use of only one tool—a screwdriver. The body of the range is 23 in. square and weighs less than 150 lb. There are four heating elements on top of the range, two open type and two closed type. The two closed elements include a family-sized waffle mold and toaster drawer heated both sides at once by a divided element. At the same time that these front elements are being used for waffles and toast regular cooking operations may be carried on on the top surfaces with the same heat. All heating elements have three heats.

Constant-Current Transformers

A complete line of regulating-type constant current transformers suitable for use in connection with street-lighting underground circuits and developed for subway service has been placed on the market by the General Electric Company. The general design embodies the most important features of subway-type distribution transformers, such as cast-iron tank, cast-iron cover, suitable asbestos gasket soaked with linseed oil, oil-level-indicating plugs, eliminating the necessity of removing the cover to determine oil level, and approved standard disconnecting wiping sleeves.

The diameter of even the largest of these transformers does not exceed 30.5 in., which permits them to be passed through 32-in. manholes. These transformers are built in capacities of 1, 2, 3, 5, 7.5, 10, 15, 20, 25 and 30 kw. The standard rated primary voltage is 2,300 volts with a 2,000-volt tap. The standard rated secondary current is 6.6 amp., and each outfit has 10 per cent additional load carrying capacity to compensate for line losses, etc. It is said that a power factor of 80 per cent is obtainable at full load. All these transformers up to the 20-kw. size are built as a single unit. The 25-kw. and 30-kw. sizes, because of the limited external dimensions, were designed "double-deck" but connected to operate as a unit both electrically and mechanically.

Automatic Welder

An automatic welder for use in the manufacture of storage tanks has been developed by the Lincoln Electric Company, Cleveland. The new automatic tank welder will completely weld a large tank in one hour and twenty-five minutes, against the old average of four hours per tank, and can be used for welding tanks of single or multiple sections. In operation the entire tank is assembled and tacked together, and the longitudinal seam welds are made by an automatic moving head attached to a single copper guide. After the seam welds are made the tank is slid on wheels and revolved under an automatic carbon head, making the girth weld. With the Lincoln equipment the average welding speed is between 50 ft. and 60 ft. an hour.

Renewable Fuse. — A new type of knife-blade renewable fuse which has only six elements has been developed by the Johns-Pratt Company, Hartford, Conn. The six elements consist of the knife blades with renewable link, a two-part spacing and lock washer, two end caps and a fiber tube with two threaded metallic ends. It is said that these six elements can be assembled in twenty seconds. The fuse links of the knife-blade elements, in sizes ranging from 61-amp. to 100-amp. capacity, have slotted ends so that loosening of the two bolts is sufficient to permit their release and replacement. In the 110-amp. to 600-amp. capacities complete assembling of the bolts is required as the ends of the link are not slotted.

New Trade Literature

SWITCH INTERLOCKS.—Bulletin No. 105-29-B issued by Charles Cory, Inc., 183 Varick Street, New York City, describes the various types of the "Robinson" switch interlocks. Illustrations are given showing many typical methods of application to oil circuit breakers, cell doors and disconnecting switches. Drawings showing the interior construction and connection terminals and the schematic layout and wiring diagram of the "Robinson" interlocking system are also given.

APPARATUS FOR MARINE APPLICATION. — "Westinghouse Apparatus for Marine Application" is the title of a book issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., covering its marine equipment. This book contains 528 pages and is the first of its kind to be issued on the application of mechanical steam and electrical apparatus for marine use. In addition to a complete description of the Diesel engine, turbine-electric and turbine-geared drive and apparatus manufactured by the company, the book contains complete mechanical, steam and electrical data which are of special interest to the engineering and chief operating personnel of the marine industry.

ELECTRICAL MEASURING INSTRUMENTS. — The Jewell Electrical Instrument Company, 1640 Walnut Street, Chicago, has issued catalog No. 15, covering the Jewell electrical measuring instruments. It describes and illustrates the various types of movements used with the Jewell switchboard instruments. It also contains descriptions of its automotive testing, X-ray and electro-therapeutic instruments, radio apparatus and instrument transformers. The descriptions of instruments are combined with the prices and listings on the same page where the instruments are illustrated.

DISTRIBUTION TRANSFORMERS. — Bulletin No. 2,042 issued by the Pittsburgh Transformer Company, Pittsburgh, Pa., covers the Pittsburgh single-phase distribution transformers. It contains an illustration showing winding of coils for a 15,000-kva. Pittsburgh polyphase power transformer.

PYROMETERS. — The Republic Flow Meters Company, 2240 Diversey Parkway, Chicago, has issued catalog No. P-29, in which it describes and illustrates the equipment, methods and products used in the manufacture of the "Republic" pyrometers. It contains a chart which gives a full-size view, showing upper recording mechanism and charts; color temperature scale, wiring diagrams, drilling dimensions, Fahrenheit-millivolt equivalent charts, tables of conversion of Fahrenheit and centigrade scales, and melting points of chemical elements.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

Purchase and agency is desired in Wellington, New Zealand (No. 14,427), for electric air pump for garages.

An agency is desired in Westmount, Canada (No. 14,428), for electric fixtures.

An agency is desired in Alexander, Egypt (No. 14,493), for medium priced electric fans and electric irons. (No. 14,456) for radio sets, mounted and unmounted.

Purchase and agency is desired in Barcelona, Spain (No. 14,434), for lamps, bulbs, flashlights and stop signals for use on automobiles.

An agency is desired in Poona, India (No. 14,438), for electrical machinery.

An agency is desired in Cape Town, South Africa (No. 14,424), for electric motors.

An agency is desired in Brussels, Belgium (No. 14,454), for electric motors, controlling apparatus, recorders and meters, radio sets and accessories, wiring and insulating materials and electric drills.

Purchase and agency is desired in Montevideo, Uruguay (No. 14,461), for motors, electrical supplies and electric starters for automobiles.

An agency is desired in Sydney, Australia (No. 14,455), for radio sets and accessories.

An exclusive agency is desired in Beirut, Syria (No. 14,457), for radio sets and accessories.

An agency is desired in Belfast, Ireland (No. 14,458), for radio sets and accessories.

Purchase and agency is desired in Shanghai, China (No. 14,460), for radio sets and accessories.

An agency is desired in Vienna, Austria (No. 14,460), for radio sets and accessories.

Purchase is desired in Bombay, India (No. 14,508), of household electrical refrigerating plants.

New Incorporations

THE EAST GEORGIA POWER COMPANY, Atlanta, Ga., has been incorporated with a capital stock of $5,000,000 by H. M. Atkinson, P. S. Arkwright, C. G. Adsit and F. L. Butler. The company proposes to supply electricity to Augusta and the territory between that city and Toccoa, Ga.

THE SUMMER GROVE (LA.) UTILITY COMPANY has been chartered with a capital stock of $12,000. The officers are: J. P. Wilkerson, president, and G. T. Gibbs, secretary.

THE BARKLEY-KEENER ELECTRIC COMPANY, Lincolnton, has been incorporated with a capital stock of $15,000 by Frank Barkley and P. M. Keener.

THE CENTRAL LOUISIANA POWER COMPANY, 1422 Munsey Building, Baltimore, has been incorporated by Herman A. Lang and Joseph Slattery.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

KEENE, N. H. — The Burdette Chair Company contemplates the installation of electric power equipment in connection with the proposed rebuilding of its plant, recently damaged by fire, with loss of about $100,000.

BOSTON, MASS.—The installation of an ornamental lighting system on Washington and Warren Streets, in the Roxbury district, to cost about $25,000, is under consideration by the Department of Public Works.

NEW HAVEN, CONN.—The American Steel & Wire Company plans to install coal conveyors, new coal bunker, and other equipment in connection with extensions and improvements in its power house on Fairmount Avenue, to cost about $50,000.

Middle Atlantic States

BUFFALO, N. Y.—The Cleveland & Buffalo Transit Company, 16 Eagle Street, plans to install electric power equipment in connection with a proposed freight terminal at the foot of Erie Street, to cost about $1,200,000. William S. Lougee, Marshall Building, Cleveland, Ohio, is architect.

BUFFALO, N. Y.—The Seneca Transmission Company, Inc., has petitioned the Public Service Commission for permission to build an electric plant on the Seneca Indian Reservation in the towns of Hanover, Collins and Perrysburg, and for approval of exercise of rights therefor. The Niagara, Lockport & Ontario Power Company has applied to the commission for permission to purchase the capital stock of the company of the Seneca Transmission Company, Inc.

CHAMPLAIN, N. Y. — The Champlain Electric Company is negotiating for the purchase of the properties of the Chasm Power Company, Chatham, and the Norman I. White plant of Ellenburg. If the deal is carried through the company proposes to erect a 22,000-volt transmission line, about 7 miles long, connecting the lines of the Chasm Power Company and White plant, to cost about $17,500; also a substation in at Ellenburg Depot. Eventually the transmission line would be extended from the White plant to the station in Champlain. Street-lighting systems in Burke, Cherubusco and Champlain will also be rebuilt.

LITTLE VALLEY, N. Y.—The W. R. Case & Sons Cutlery Company plan to build a power plant in connection with a proposed factory addition on Rose Street.

TARRYTOWN, N. Y.—The contract for the construction of a local substation has been awarded by the Westchester Lighting Company, Mount Vernon, to the H. Wales Lines Company, Meriden, Conn.

TONAWANDA, N. Y.—A site for a substation has been acquired by the Tonawanda Power Company, North Tonawanda, on the south city line along the Military Road. In addition to building the substation the company rebuild the transmission line between the Ellicott Creek line and the new station, replacing the wooden poles with steel towers.

ENGLEWOOD, N. J.—Plans are being prepared for the construction of a power house at the Englewood Hospital. Crow, Lewis & Wick, 200 Fifth Avenue, New York, are architects.

NEWARK, N. J.—Bids will be received by the Board of Education, City Hall, until April 23 for electrical work in the West Side High School, on South Orange Avenue near Twelfth Street. James O. Betelle, Chamber of Commerce Building, is architect.

CARROLLTOWN, PA.—The Carrolltown, Ashville, Mapleton, Chest Springs, Mill Creek and Wilmore Light & Power Companies are being organized by local interests, to construct and operate transmission lines in the boroughs for which named. The companies are represented by John Stokes Adams, Bullitt Building, Philadelphia.

PHILADELPHIA, PA. — The Reading Company, Reading Terminal, plans to install electric power equipment at its proposed grain elevator and dock on the waterfront, to cost about $3,000,000.

PITTSBURGH, PA. — The West Penn Power Company plans to install a new unit at its Springdale plant, to cost about $1,500,000.

CENTERVILLE, MD.—Plans are under consideration to extend the transmission lines of the municipal electric system from Church Hill to Sudlersville, a distance of 7 miles. L. D. Shank is manager of the municipal electric plant.

BEDFORD, VA.—Plans are under consideration for extensions and improvements to the municipal hydro-electric plant on the James River, to cost about $63,000. The proposal to issue the bonds will be submitted to the voters on April 11.

HAMPTON ROADS, VA.—Bids will be received by the Marine Corps, Hampton Roads, until April 20, for one motor-generator set and one field radio set.

RICHMOND, VA.—Plans are being considered by the Virginia Railway & Power Company for the construction of a hydro-electric power plant in this vicinity, to cost about $850,000. The company also plans to erect a steel tower 110,000-volt transmission line from Suffolk to Roanoke Rapids.

WASHINGTON, D. C.—Bids will be received at the office of the General Purchasing office the Panama Canal, Washington, D. C., until May 4, for boiler, cable, wire, motors, electric drills, batteries, street globes, transformers, rectifiers, rheostats, electrical fixtures and fittings, etc., as per circular No. 1,663.

WASHINGTON, D. C.—Bids will be received by the Chief Signal Officer, United States Army, until April 21, for 600 switchboard tools, eight switchboard panels, four relay mountings, telephone brackets, switchboard lamp sockets, retardation coils, one jack mounting, connectors, sixty switchboard jacks, etc. (Proposal C. P. 20699-1.)

North Central States

OWOSSO, MICH.—The Consumers Power Company, Jackson, which is rebuilding its power lines in many parts of the city, plans also to build another substation, near its present station, doubling the present capacity.

BARBERTON, OHIO. — The Lambert Tire & Rubber Company plans to build a power house at its mill.

HAMILTON, OHIO.—The City Council has authorized the rebuilding of the municipal electric plant, at a cost not to exceed $500,000, the money to be derived from a bond issue of $650,000 voted more than two years ago.

LIMA, OHIO.—The School Board has adopted a recommendation for installing a new lighting system in all schools.

GREENSBURG, KY. — The Kentucky Utilities Company, Louisville, has acquired the electric system of the Greensburg Milling Company and plans to erect a 33,000-volt transmission line from Campbellville. Arrangements have been made with the milling company to electrify its flour mill.

LEBANON JUNCTION, KY.—The Lebanon Junction Light & Power Company contemplates rewiring a portion of the town during 1925. J. T. Wickersham is president.

LOUISVILLE, KY.—The Continental Car Company plans to install electric power equipment in connection with the proposed rebuilding of its plant, including switchboard room, etc., recently damaged by fire, causing a loss of about $500,000.

LOUISVILLE, KY. — Plans have been filed for an addition to the Puritan Apartment Building at Fourth and Ormsby Street, to cost $226,000. It is proposed to build a large power house in the rear to furnish light and heat for the apartment and also heat for the homes in the block on Fourth Street between Oak and Ormsby Streets.

COLUMBIA CITY, IND.—Bids will be received by the City Council until April 21 for equipment for the municipal electric power plant, including one 750-kva. electric generator, one uniflow-type engine, vertical jet condenser, switchboard and auxiliary equipment. H. W. Jacobsen, 210 East Forty-sixth Street, Chicago, is engineer.

FORT WAYNE, IND.—Plans are under consideration by the Indiana Service Corporation for the erection of an electric transmission line between Fort Wayne and Warsaw, via Columbia City, to cost about $120,000.

MISHAWAKA, IND.—The installation of a new switchboard in the municipal electric light plant is under consideration. A. R. Klein is superintendent.

VALPARAISO, IND.—The Calumet Gas & Electric Company, Gary, plans extensions and improvements in its local plant and system, to cost about $110,000.

ALBION, ILL. — The Albion Electric Company has applied for permission to erect a transmission line between Bellmont and Keensburg and to build a distributing system in the latter place; also to erect a line ⅛ mile south of Bellmont.

CHICAGO, ILL. — The Public Service Company of Northern Illinois, Chicago, has applied for permission to build a substation in Township 35 in Cook County.

CHICAGO, ILL.—The Central Cold Storage Company, North Clark Street and the Chicago River, plans to install electric power equipment in a proposed cold storage and refrigerating plant at South Sangamon and Morgan Streets, to cost about $1,000,000.

CROPSEY, ILL.—The Cropsey Light & Water Company has applied for permission to construct and operate an electric plant and distribution system and to supply water in the town of Cropsey.

NILWOOD, ILL.—The Illinois Power & Light Corporation, Chicago, has applied for authority to erect an electric distributing system in Nilwood.

GREEN BAY, WIS.—The City Council is considering petitions for the installation of ornamental street-lighting systems on North Broadway, South Broadway, Dousman and West Main Streets.

GREEN BAY, WIS. — The Northern Paper Mills, we are informed, does not contemplate building a hydro-electric plant on the Peshtigo River, as reported in the issue of April 4.

MADISON, WIS. — Permits have been granted to the Madison Gas & Electric Company for the construction of an addition to the boiler house and a generator room at its plant at Main and Blount Streets, to cost about $150,000.

MAUSTON, WIS.—The Wisconsin Power & Light Company, Madison, which has acquired the electric system of the Mauston Electric Service Company, plans to erect an extension about 10 miles long, from its transmission line connecting New Lisbon and Elroy, to connect with its other properties.

MONTELLO, WIS. — The transmission and distribution systems of the Montello & Harrisville Light & Power Company have been purchased by the Wisconsin Power & Light Company, Madison. The former company, which retains the generating plant, will sell power to the purchasing company. To assure continuous service in these towns the Wisconsin Company will erect a transmission line from Dalton to Montello, 15 miles long, to tie in these properties with its main system.

PORTAGE, WIS.—Bids will be received by C. J. Loomis, city clerk, until April 28 for furnishing and installing an ornamental lighting system, consisting of fifty-four lamps. C. H. Shepherd, 38 South Dearborn Street, Chicago, is consulting engineer.

WEST BEND, WIS.—Plans are under consideration by the City Council to replace the present lighting system on Main Street and Fourth Avenue with fifty-two ornamental standards, equipped with lamps of 600 cp.

HIBBING, MINN.—The contract for construction of the addition to the municipal electric plant has been awarded to the Phelps-Drake Construction Company.

MILTON, IOWA. — The Iowa Southern Utilities Company, Centerville, has acquired the local lighting system, and is planning reconstruction of same, including changing the present street lamps to bracket lamps, extensions and general overhauling of lines.

SPRAGUEVILLE, IOWA.—Bonds to the amount of $2,000 have been authorized by the voters for the erection of a transmission line into the town.

FAUCETT, MO.—The Missouri Gas & Electric Service Company, Cainsville, plans to erect a transmission line from Dearborn, to Faucet to furnish commercial service here.

TRENTON, MO.—The Trenton Gas & Electric Company is considering extensions and improvements in its electric power plant, including the installation of additional equipment.

FRYBURG, N. D. — Elmer E. Martin plans to build an electric power plant for local commercial service.

GRAND FORKS, N. D.—An appropriation of $24,650 has been authorized for the purchase of equipment for the power plant at the local State University. Thomas F. Kane is president of the institution.

ALLIANCE, NEB.—Plans are under way for extensions and improvements in the municipal electric lighting system. The Burns & McDonnell Engineering Company, Interstate Building, Kansas City, Mo., is engineer.

CROFTON, NEB.—The installation of a generator, engine, and auxiliary equipment in the municipal electric power plant is under consideration.

VALENTINE, NEB.—The local electric plant of the S. F. Gilman Mill Company has been taken over by the Tri-State Utilities Company, Minneapolis.

WAKEFIELD, NEB. — At an election held recently the proposal to purchase the plant of the Westfield Electric Company, to be owned and operated by the municipality, was carried.

Southern States

CHARLOTTE, N. C.—Plans have been completed by the Southern Power Company for the construction of an additional hydro-electric plant on the Catawba River, at Rocky Creek in Lancaster County, S. C. The proposed plant will cost about $1,250,000 and will have a generating capacity of 60,000 hp.

ELLENBORO, N. C. — The Council is planning to erect transmission lines into the rural districts. O. R. Coffield is Mayor.

FOREST CITY, N. C.—The State Legislature has authorized Forest City to issue $250,000 in bonds for street improvements, sewerage, waterworks and electric lamps.

GREENVILLE, S. C.—The City Council has authorized an extension of the ornamental lighting system on East Washington Street.

ATLANTA, GA.—Right-of-way is being secured by the East Georgia Power Company, recently incorporated, for the erection of a transmission line from Toccoa to Augusta, a distance of 112 miles, where it will connect with the lines of the Georgia-Carolina Power Company, Augusta. The proposed line will supply power in Augusta and the territory between that city and Toccoa. The cost is estimated at about $1,500,000. H. M. Atkinson and P. S. Arkwright are among the incorporators.

BOWLING GREEN, FLA.—The Florida Public Service Company, Orlando, has acquired the municipal lighting system, and plans extensions and improvements, including transmission line extensions.

DAVENPORT, FLA. — Bonds to the amount of $10,000 have been voted for the installation of an ornamental lighting system.

LAKELAND, FLA.—Extensions are contemplated to the municipal electric plant during 1925 including the installation of a 3,125-kva. General Electric turbo-generator, Elliott surface condenser, one 25-ton Bement-Pond electric traveling crane and additions to switchboard and building. Equipment has already been purchased. Charles Larsen is superintendent of light and water department.

PENSACOLA, FLA.—Bids will soon be asked by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for motors, electrical work, pumping machinery, etc., for a water supply system at the local naval air station (Specification 5054).

ST. AUGUSTINE, FLA.—Plans are being prepared for extensions to the plant of the St. Johns Electric Company.

SARASOTA, FLA.—The City Council has passed an ordinance authorizing extensions and improvements to the municipal electric light plant and an issue of $350,000 in bonds to provide funds for same. An election will be held May 7 to vote on the proposed bond issue.

McMINNVILLE, TENN.—The system of the Walling Light & Power Company has been acquired by the Tennessee Electric Power Company, Chattanooga, which plans to erect a transmission line from its Rock Island plant to supply service here.

TROY, ALA.—The Gulf Electric Company, B-M Building, Birmingham, has acquired the plant of the Pea River Power Company and plans to erect transmission lines through Union Springs to Pensacola, Fla., Troy and other Alabama towns.

GRENADA, MISS.—The municipal electric plant has been acquired by the Mississippi Power & Light Company, Jackson.

NATCHEZ, MISS.—The City Council has granted the Southern Railway & Light Company a ten-year franchise, which provides for the installation of an ornamental lighting system, to cost about $30,000. Henry A. Mentz, Magnolia, is consulting engineer.

BAYNE, LA.—The installation of about forty street lamps is under consideration. E. J. Bertrand is superintendent of the municipal water and light plant.

LAFAYETTE, LA.—Another 600-hp. oil engine will be installed in the municipal waterworks and electric light plant during the coming summer. Wilson J. Peck is trustee of public property.

PORT ALLEN, LA.—The Baton Rouge Electric Company, Baton Rouge, is considering the erection of a transmission line into this section for light and power service.

DAWSON, OKLA.—Plans for proposed local cement mill, to cost about $1,000,000, include a power plant. A company will be organized to carry out the project. I. P. Crow, 320 South Boulder Street, Tulsa, is interested.

VICI, OKLA.—Surveys are being made for a municipal electric distribution system and for a transmission line from Vici to Woodward, a distance of 28 miles, to cost about $30,000. The Gantt-Baker Company, 1116 West Main Street, Oklahoma City, is engineer.

GALVESTON, TEX.—Bids will be received by the Chief of the Bureau of Yards and Docks, Navy Department, Washington, D. C., until April 29, for the construction of an electric power line at the local naval radio compass station (Specification 5053).

Pacific and Mountain States

ANACORTES, WASH.—The Puget Sound Power & Light Company, Seattle, plans to erect a 2,300-volt transmission line on Happy Valley Road and Commercial Avenue.

KALAMA, WASH. — The Lewis River Pulp & Paper Company is considering plans for the construction of a power house at its proposed local paper mill, to cost about $500,000.

KELSO, WASH. — The Puget Sound Power & Light Company, Seattle, plans to build a substation near the Kalama River, to be used in connection with a transmission line from Rainier, Ore.

LAGUNA BEACH, CAL.—The formation of a lighting district on the new coast highway which will be opened in the near future is under consideration by the city officials.

LONG BEACH, CAL.—The City Council has adopted a resolution providing for the installation of ornamental lighting systems on Pine Avenue and Third Street.

LOS ANGELES, CAL.—The City Council has approved ordinances for the installation of ornamental lighting systems as follows: On portion of Main Street, using pressed-steel standards; Hillhurst Avenue,

Ogden Drive, Genesee Street, Fifty-third Street, Sixty-seventh Street and Stanley Avenue, all concrete standards.

MANTECA, CAL.—The South San Joaquin Irrigation District, Manteca, and the irrigation district of Oakdale plan to call an election to vote on the proposal to issue $2,200,000 in bonds for the Melones project, which includes a 585-ft. concrete radius-type dam, about 210 ft. high, creating a reservoir of 112,000 acre-ft. capacity; pressure tunnel (1 mile) to power house, also railroad, pumping plant, etc. The power plant in connection with the above project is to be built by the Pacific Gas & Electric Company, San Francisco, at a cost of about $2,500,000.

OAKLAND, CAL.—The Key System Transit Company plans to build a substation at its local pier, to cost about $22,000.

OROVILLE, CAL.—The Pacific Gas & Electric Company, San Francisco, has applied to the State Division of Water Rights for the storage of 14,500 acre feet of water for electric power purposes, to cost about $570,000, all to be expended in northern Butte County. The first project calls for the diversion of 5,740 acre-feet from Clear Creek, to cost about $253,900, the second calls for the diversion of 3,700 acre-feet from the West Branch of the Feather River, to cost $182,000, which calls for the erection of a dam 15 ft. high and 100 ft. long, near Inskip. The third calls for 5,600 acre-feet of water to be diverted from Philbrook Creek, a tributary of the West Branch for use in the De Sabla district power station. A dam 15 ft. high and 100 ft. long, including head gates and flumes will cost about $134,400.

SAN FRANCISCO, CAL.—Bids will be received by the Chief of the Bureau of Yards and Docks, Navy Department, Washington, D. C., until May 6 for one electric passenger elevator for the Marine Corps Depot of Supplies (Specification 5081).

SAN GABRIEL, CAL.—The Board of City Trustees is considering the installation of ornamental lighting systems in Rosemead and Bradbury Parks.

SAN LEANDRO, CAL.—The Pacific Gas & Electric Company, San Francisco, plans to build a local substation, to cost about $200,000.

VALLEJO, CAL.—A contract has been awarded to the Vallejo Light & Power Company for the installation of an ornamental lighting system on Marin Street, from York to Florida Streets.

VICTORVILLE, CAL.—Plans are being prepared by the Appleton Land, Water & Power Company, Washington Building, Los Angeles, to develop 2,000 hp. to operate pumps for irrigating 20,000 acres. H. Hawgood, H. W. Hellman Building, Los Angeles, is engineer.

LEWISTON, IDAHO.—The Inland Power & Light Company, Portland, Ore., and the Clearwater Timber Company, Potlach, Idaho, have submitted a joint proposal to the City Council whereby the former agrees to construct at once a dam and power house, and the latter a sawmill, provided that the city will secure for them at reasonable terms the necessary lands and rights-of-way and withdraw its application for a permit to develop power on the Clearwater River. The proposal calls for a 10,000-kw. power plant and a sawmill having a capacity for 200,000,000 ft. per year, to be located about 4 miles above the confluence of the Clearwater River with the Snake River.

GARDINER, MONT.—The Yellowstone Park Transportation Company plans to install electric power equipment at its proposed machine works to cost about $150,000.

GRAND JUNCTION, COL.—The Grand Junction Gas & Electric Company is planning to double the output of its electric plant. The cost is estimated at about $40,000.

Canada

AMHERSTBURG, ONT.—Extensions are contemplated to the local system of the Hydro-Electric Power Commission of Ontario, to cost about $25,000.

COCHRANE, ONT.—The installation of a 240-hp. oil engine in the municipal electric light plant is under consideration. Frank Graff is manager.

TORONTO, ONT.—Improvements are contemplated to the electric lighting system in the downtown section, including cast iron standards, underground conduits, etc. The cost is estimated at $30,000. R. C. Harris is city engineer.

TORONTO, ONT.—Tenders will be received by registered post only, addressed to the chairman of Board of Control, City Hall, until April 21 for feeder switches for filtration plant, tender No. 45.

Electrical Patents

Announced by U. S. Patent Office

(Issued March 17, 1925)

1,530,200. SYSTEM OF WIRING CONDUITS FOR BUILDING CONSTRUCTION; H. F. Richardson, Brooklyn, N. Y., and A. Coggeshall, Pleasantville, N. Y. App. filed Nov. 4, 1921.

1,530,201. CUT-OUT INSULATOR FOR ELECTRIC CIRCUITS; J. N. Robinson, Hokitika, New Zealand. App. filed Jan. 3, 1923.

1,530,206. LANTERN OR LAMP; C. J. Saager, Blue Island, Ill. App. filed July 8, 1922. Dry-cell type.

1,530,216. ELECTRICALLY HEATED CUSHION AND THE LIKE; V. G. Steer, Killara, New South Wales, Australia, and F. McLennan Lennard, Darlinghurst, Sydney, New South Wales, Australia. App. filed Oct. 8, 1923.

1,530,219. DUPLEX AND LIKE TELEGRAPHY; H. W. Sullivan, London, England. App. filed April 25, 1922.

1,530,228. COMPOSITE PACK FOR ELECTRICAL HEATING ELEMENTS; W. A. Braun, Dover, Ohio. App. filed Jan. 5, 1923.

1,530,241. PROTECTIVE DEVICE; E. E. F. Creighton, Schenectady, N. Y. App. filed March 19, 1924. Fuse with a plurality of elements.

1,530,245. ELECTROMAGNETIC ENERGY-DIRECTION AND POWER-FACTOR INDICATOR; R. Dietze, Pankow, Germany. App. filed Sept. 5, 1922.

1,530,264. ELECTRIC FUSE; V. Hope, Macclesfield, England. App. filed Oct. 16, 1924. Powder-filled cartridge type.

1,530,274. SOLDERING POT; W. L. Martin, Cleveland, Ohio. App. filed March 30, 1923.

1,530,290, 1,530,291. PROTECTIVE APPARATUS; J. Biermanns, Karlshorst, Germany. App. filed April 11, 1924. Relay for selectively controlling the circuits of parallel lines upon the occurrence of abnormal circuit conditions.

1,530,298. KNOB; Y. J. Chambless and A. L. Lee, Panama City, Fla. App. filed Feb. 21, 1923. For use in anchoring wires to the walls of buildings.

1,530,304. SYNCHRONIZING DEVICE; I. E. Cox, St. Louis, Mo. App. filed April 24, 1923. Two alternating electromotive forces.

1,530,319. FUSE PLUG; H. T. Paiste, Philadelphia, Pa. App. filed Oct. 27, 1922. Renewable.

1,530,322. ELECTRICAL MEASURING INSTRUMENT; W. H. Pratt, Lynn, Mass. App. filed Jan. 17, 1921. For the measurement of kilovolt-ampere-hours.

1,530,323. METER DRAG MAGNET; W. H. Pratt, Lynn, Mass. App. filed Aug. 11, 1922.

1,530,335. OPERATION OF ELECTROLYTIC CELLS; H. L. Ward, Chicago, Ill. App. filed March 4, 1922. For the prevention of acid spray in electrolytic solutions.

1,530,363. CHRONOPHONE; J. F. Hayden, High Point, N. C. App. filed April 14, 1920. Whereby the user of a telephone may call for a special number and the machine will at once give the time in audible words.

1,530,364. AMPLIFIER; E. F. Hemelly, Schenectady, N. . App. filed June 26, 1922. Of the magnetron type.

1,530,365. DISCONNECTING SWITCH; C. H. Hill, Schenectady, N. Y. App. filed Dec. 15, 1923. High-tension type for outdoors.

1,530,376. HIGH-FREQUENCY MACHINE; G. Krawinkel, Gummersbach, Germany. App. filed Aug. 15, 1921.

1,530,377. SYSTEM OF MOTOR CONTROL; G. Lamberton, Elyria, Ohio. App. filed Aug. 6, 1921. For pusher machines for coke ovens.

1,530,379. MANUALLY OF AUTOMATICALLY RESET SWITCH; G. Leddick, Schenectady, N. Y. App. filed Dec. 16, 1920.

1,530,419. ELECTRIC ALARM APPARATUS; G. Schmidt, Reinickendorf-Ost, Germany, and C. Boker, Berlin, Germany. App. filed May 6, 1921. Burglar or fire alarm.

1,530,443. GROUP-FEEDER CONTROL SYSTEM; O. C. Traver, Schenectady, N. Y. App. filed March 30, 1921. For a plurality of feeders connected to a common distributing bus which is connected to a supply circuit by a group feeder.

1,530,444. CIRCUIT BREAKER; H. Trencham, Ruislip, England. App. filed Sept. 22, 1922. Rapid-break type.

1,530,449. ELECTRIC MOTOR; A. F. Welch, Fort Wayne, Ind. App. filed March 28, 1922. Adapted to be driven either by alternating current or direct current and adjustable in speed as phonograph motors.

1,530,463. RADIO VISION MECHANISM; C. F. Jenkins, Washington, D. C. App. filed April 23, 1924.

1,530,466. INDUCTION-MOTOR WINDING; C. Macmillan, Schenectady, N. Y. App. filed Aug. 8, 1924. Substantially free from detrimental harmonics.

1,530,468. VAPOR ELECTRIC GENERATOR; W. St. G. Elliott, New York, N. Y. App. filed July 22, 1922. For generating an electric current in which the motion of a conducting vapor past and through a magnetic field induces an electric difference of potential in the vapor.

(Issued March 24, 1925)

1,530,469. AUTOMATIC ARC-WELDING MACHINE; J. L. Adams, Jr., Milwaukee, Wis. App. filed July 17, 1920. For welding the meeting edges of tubular sections.

1,530,471. SOCKET; J. R. Allen, Chicago, Ill. App. filed July 6, 1920. Pull-chain type.

1,530,482. SIGNALING SYSTEM AND METHOD; G. C. Cummings, Orange, N. J. App. filed March 15, 1922. For operating composite telephone and telegraph systems.

1,530,498. SYNTHESIS OF COMPOUND TONES BY VACUUM-TUBE OSCILLATORS; B. W. Kendall, New York, N. Y. App. filed Nov. 20, 1917.

1,530,500. INSULATOR CLEVIS; W. D. Kyle, Milwaukee, Wis. App. filed Jan. 10, 1920.

1,530,512. ELECTRIC IRON; F. A. Patterson and C. Reinecke, Maplewood, Mo. App. filed May 24, 1922. Automatic or manual control.

1,530,514. TELEGRAPH SYSTEM; P. M. Rainey, Glen Ridge, N. J. App. filed April 27, 1920. Current impulse repeater.

1,530,537. ELECTRICAL TRANSPOSITION SYSTEM; H. A. Affel, Brooklyn, N. Y. App. filed Aug. 31, 1922. For the simultaneous transmission of a plurality of frequencies or bands of frequencies.

1,530,548. SIGNALING; L. Espenschied, Queens, N. Y. App. filed March 30, 1920. Telephone transmission systems.

1,530,555. X-RAY TUBE; G. R. Greenslade, Pittsburgh, Pa. App. filed May 24, 1922.

1,530,561. MOTOR CONTROL; K. Hoffman, Lorain, Ohio. App. filed Nov. 25, 1922. For the driving motors of coupling-screwing machines and the like in which the work load varies.

1,530,567. PRINTING TELEGRAPHY; A. E. Lundell and A. B. Sperry, New York, N. Y. App. filed Dec. 21, 1920.

1,530,572. ELECTRIC SNAP SWITCH; E. Moxter, St. Louis, Mo. App. filed Oct. 10, 1921.

1,530,580. SWITCH CONTROL CIRCUIT FOR AUTOMATIC TELEPHONE SYSTEMS; A. B. Smith, Evanston, Ill. App. filed Sept. 19, 1919.

1,530,582. BATTERY-CHARGING CLIP; G. J. Tremayne, St. Louis, Mo. App. filed May 28, 1921.

1,530,601. TELEPHONE SYSTEM; L. D. Kellogg, Deerfield, Ill. App. filed Jan. 31, 1921. Automatic or semi-automatic system.

1,530,613. ELECTRICAL CIRCUITS; P. H. Pierce, New York, N. Y. App. filed Sept. 16, 1920. Adapted to be associated with repeaters and amplifiers of alternating currents.

1,530,617. FLEXIBLE TUBING FASTENER; H. A. Porter, San Francisco, Cal. App. filed Nov. 13, 1922. Which can be readily inserted in the opening of a switch box.

1,530,620. VACUUM-TUBE CIRCUITS; H. S. Read, New Haven, Conn. App. filed March 17, 1920.

1,530,633. ELECTRICAL CIRCUITS, APPARATUS AND METHOD; D. F. Whiting, New York, N. Y. App. filed Aug. 30, 1920. Adapter to be associated with repeaters and amplifiers of alternating currents.

1,530,640. JACK; E. Batchelder, New York, N. Y. App. filed March 19, 1924.

1,530,648, 1,530,649. ELECTRIC CIRCUITS; W. L. Casper, Brooklyn, N. Y. App. filed April 20, 1921. Vacuum-tube circuit.

1,530,658. ALARM MECHANISM; E. A. Faller, Brooklyn, N. Y. App. filed Sept. 25, 1918. Such as is used in fire-alarm, telegraph and similar systems.

1,530,660. PRINTING-TELEGRAPH SYSTEM; W. F. Friedman, Washington, D. C. App. filed July 26, 1922.

1,530,664. ELECTRIC SWITCH; A. C. Grunwald, River Forest, Ill. App. filed Dec. 24, 1921. For stop-signal systems.

1,530,666. MULTIPLEX SYSTEM FOR THE TRANSMISSION OF RADIANT ENERGY; J. H. Hammond, Jr., Gloucester, Mass. App. filed Oct. 31, 1917.

1,530,684. ANTENNA SYSTEM; J. O. Mauborgne and G. Hill, Washington, D. C. App. filed June 29, 1921. Consisting of a flat spiral wave coil.

1,530,685. REPEATER CIRCUITS; J. B. Morrill, St. Louis, Mo. App. filed Nov. 6, 1920. Vacuum-tube circuit.

1,530,687. DOUBLE-FILAMENT VACUUM TUBE; C. Murray, Washington, D. C. App. filed Aug. 7, 1923.

Financial and Corporate

Utility Stocks Advance

Improving Tone Becomes Evident as Special Issues Take Upward Turn

TRADING in public utility stocks during the week under review was broken by the Easter holidays, but, notwithstanding the somewhat reduced volume, prices held firm or improved over their levels of the week before. The market in utility shares generally appears to have turned again for the better, but its behavior in so doing very much resembles that of the New York Stock Exchange market.

The resemblance comes in the tendency of traders to select particular stocks for accumulation. The general rule of the last year or two often has been to pick certain market leaders, the theory being that improvement in the industry would be best reflected by the principal stocks. The plan now is more to select stocks that have been neglected or for which special reasons give a promise of better market quotations. Thus during the past week such leaders as American Power & Light, Commonwealth Power, Electric Bond & Share and others of that type changed but little in price.

On the other hand, Adirondack Power & Light improved its position by advancing another nine points, setting a new high record around 59 as compared with a price of 35 not long ago. Adirondack's strength results in part from merger talk and in part from increased earning possibilities. Southeastern Power & Light again has turned stronger and last week added five points to its previous level. Gains were made by Northern Ohio Power, Arizona Power, Carolina Power & Light, Cities Service Electric, Lehigh Power Securities and National Power & Light. American Light & Traction stock weakened ten points during the week as a result of selling by those who had expected more in the way of dividends than the increased cash distribution.

New Capital Issues

During the past week the Erie County Electric Company, Erie, Pa., floated a one-million-dollar issue of general and refunding mortgage gold bonds priced at 99½ and interest, yielding 5.53 per cent. Through its predecessor, the company is the third oldest electric light company in America and has been locally managed and controlled by the same interests for more than forty years. The company now serves over 18,000 customers and its long-established business is rapidly growing. The proceeds from the sale of the bonds will pay in part for the new 12,500-kw. unit now being installed in the power station, will pay off unfunded debt and add to the company's working capital.

The Public Service Company of Oklahoma, a subsidiary of the Middle West Utilities Company, now serving without competition seventeen Oklahoma communities with electric light and power, offered 7 per cent cumulative prior-lien stock to the amount of $1,000,000. This stock is priced at $97 per share and accrued dividend, to yield 7.22 per cent.

The Iowa Southern Utilities Company was represented with a one-million-dollar issue of 7 per cent cumulative preferred stock offered at 95 and accrued dividend to yield 7.36 per cent.

Dividends Declared

The following quarterly dividends were announced by electric light and power companies and electrical manufacturing companies during the past week:

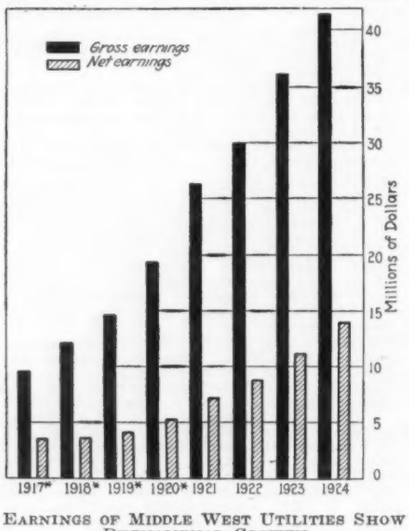
Name of Company	Per Cent	When Payable
American Light & Traction	1¾	May 1
Central Power & Light, cum. pf	$1.75	May 1
Edison Elec. Illg. Co. of Brockton	62½c	May 1
Electric Bond & Share, pf	1½	May 1
Idaho Power, pf	1¾	May 1
Fort Worth Power & Light, pf	1¾	May 1
Texas Power & Light, pf	1¾	May 1

Insull Holding Company Forges Ahead

A Growth in Annual Earnings from $3,680,676 in 1912 to $41,402,607 in 1924 Is the Record of Middle West Utilities

BY PAUL WILLARD GARRETT

THE Middle West Utilities Company was founded on the then somewhat "revolutionary idea," to quote from the company's own handbook, "that full electric light and power facilities could be profitably supplied to compact groups of smaller cities and towns through closely knit transmission systems, they being supplied with energy from efficiently operated and advantageously located central stations of large size." Prior to the time that this organization was created—May, 1912—there had been no companies formed primarily of the type proposed.



EARNINGS OF MIDDLE WEST UTILITIES SHOW PHENOMENAL GROWTH
*Year ended April 30

The growth of the Middle West Utilities Company, which is a leading holding company of the Samuel Insull group, has come during the period that the industry itself has enjoyed its greatest expansion. Operating subsidiaries of the Middle West Utilities Company showed gross earnings of only $3,680,676 in 1912, the first year of operation under the holding company, but they have made a substantial gain in every year since that time. By 1918 the 1912 total had been more than trebled, and by the end of 1924 the 1918 rate of annual earnings had been more than trebled. Gross earnings have grown by leaps and bounds, as may be illustrated by the fact that they equaled $29,870,702 in 1922, $36,185,182 in 1923 and $41,402,607 in 1924. If additional evidences of growth are sought, they may be found in the facts that the number of customers served increased from 206,172 in 1917 to 543,401 in 1924 and the electrical output in the same period from 195,974,828 kw.-hr. to 1,009,585,853 kw.-hr.

Operating subsidiaries of the Middle West Utilities Company serve 915 communities in Illinois, Indiana, Kentucky, Maine, Missouri, Nebraska, New Hampshire, New York, Oklahoma, Tennessee, Texas, Vermont and Wisconsin directly dependent upon the system. Through connections with other utilities these operating subsidiaries also are looked to for services by 290 additional communities.

This Insull organization has made unusual progress in the construction of transmission lines, additions having swollen the total mileage from 3,578 in 1919 to 8,481 in 1924.

Confidence in the management and the future of the industry have combined to make the securities of the Middle West Utilities Company popular with investors, the merits of the issues having been revealed to investors of the Chicago district somewhat sooner than to those further from the territory served. It is a testimonial to the improving position of the securities that the common stock, which some years ago was given as a bonus in the sale of the preferred stock, now sells around $95 per share, notwithstanding the fact that the common shares have never received a dividend.

That the common shares should have improved so smartly in the market

during the last year is not hard to understand when the indicated earnings on the stock are known. During 1924 earnings applicable to the common stock were equivalent to $14.43 per share, in 1923 they were $11.62, in 1922 they were $9.04, and in 1921 they were $4.86.

While increases have been made to the volume of outstanding stock since 1921, the funded debt has been reduced to less than half of what it was at that time. Counting nearly $45,000,000 of cumulative prior lien and cumulative preferred shares, the capital stock outstanding at the end of 1924 totaled about $57,000,000 and the funded debt outstanding in the hands of the public was $5,765,600. Assets of the holding company, including plants, securities and good will, stood at $66,000,000 and surplus at $3,200,000. There is every reason to expect Middle West Utilities common to enter the class of dividend payers soon and eventually to become one of the more stable issues among our common-stock utility investments.

Annual Reports of Electric Light and Power Companies

Standard Gas & Electric Company in the twelve months ended December 31, 1924, had the most successful year in its history. In the annual report to the stockholders, just issued, President John J. O'Brien states that gross earnings totaled $6,098,532, showing an increase of 17.35 per cent, while the balance after all expenses, taxes and interest amounted to $3,763,971, an increase of 27.99 per cent over the previous year. The balance available for common-stock dividends was equal to $6.61 a share on the 302,693 shares outstanding December 31, 1924, there having been an increase of 90,693 shares during the year, due to the conversion of debenture bonds. After payment of the regular dividends on the 7 per cent prior preference, 8 per cent preferred and 6 per cent non-cumulative stock, and $3 a share on the common stock, there remained a balance for the year 1924 of $1,206,638. The operated utility companies, as a whole, enjoyed good growth in business and earnings. Some made gains much better than usual, but the combined results reflected the agricultural and industrial conditions prevailing in a large part of the territory served during the greater part of the year. Combined gross earnings of the operated companies, excluding the Mobile Electric Company, which has been sold since the end of the year, increased 9.07 per cent, and net earnings increased 13.6 per cent. The total number of customers increased from 691,041 to 740,964, and total electric connected load increased from 1,101,998 kw. to 1,241,787 kw. Electrical energy output for the year amounted to 1,469,377,905 kw.-hr. Operated utility companies continued the successful development of the customer-ownership policy inaugurated in 1915 and at the end of the year had approximately 64,000 shareholders, a net gain of about 14,000. During 1923 and 1924 the volume of construction involving new plants, additions, improvements, transmission and distributing equipment was unprecedented. The total amount expended for these purposes was $31,388,262 in 1923 and $30,939,715 in 1924.

In the annual report for the year 1924 the United Gas & Electric Corporation reported net earnings, including net earnings of its subsidiary companies and from treasury securities after the payment of annual dividend on its preferred stock, equivalent to approximately $3.29 per share on the common stock outstanding. The gross earnings of the subsidiary operating companies amounted to $12,297,568, an increase of $641,916 over the previous year. The subsidiary companies expended or reserved $1,892,758 for repairs, maintenance, renewals and replacements. The combined credit balance in the reserves for renewal and replacements of the subsidiary companies as of December 31, 1924, was $3,839,244. The capital expenditures of the subsidiary companies for the improvement and extension of plant and equipment to take care of the growth of the business amounted to $3,674,303.

The year book of the Rochester Gas & Electric Corporation covering operations during 1924 shows gross income of $9,691,813, a total increase of $510,812 or 5.2 per cent over the previous year. Of this amount the electric department contributed $492,799, an increase of 9.54 per cent. The balance sheet shows the total amount invested in plant and equipment to be $39,302,555, an increase of $3,912,268 over 1923, which represents the money expended in 1924 in additions required to meet the demands for service by new and other customers.

The total revenue of the Pennsylvania Water & Power Company as recorded in its annual report for 1924 amounted to $2,686,465, and after making provision for interest charges, taxes, operation and maintenance, there remained a surplus of $1,264,837. A comparison of gross income for 1924 with 1923 shows a gain of $562,038; a like comparison of net revenue shows a gain of $282,099. The company's reserves (exclusive of $725,000 in sinking fund) show an increase over 1923 of $370,070 and now total $2,410,796.

The Illinois Power Company reports for the year ended December 31, 1924, gross earnings totaling $813,884, as compared with $749,240 for the previous year. Net income available for depreciation and dividends amounted to $339,329, leaving a balance after dividends on preferred stock of $148,179. Electric sales increased from 23,235,546 kw.-hr. in 1923 to 24,861,211 kw.-hr. in 1924, and electric customers from 11,042 to 11,831. The sum of $1,240,506 was expended for additions and improvements during 1924.

The American Gas Company and its subsidiaries for the year 1924, after all charges, earned 14.2 per cent on the average outstanding stock, of which $237,576 was left in surpluses of the subsidiary companies, $487,740 was paid in dividends and $538,613 was added to the surplus of the American Gas Company. The statement of earnings shows operating revenue of the subsidiaries amounting to $10,573,097, an increase of $671,674 over the 1923 figure. During the year 22,719 shares of preferred stock of the subsidiary companies were sold to 2,315 subscribers, making the total amount outstanding, December 31, 1924, 49,306 shares, held by 5,936 subscribers.

Company Reports

Statements of earnings issued during the past week by electric light and power companies for the month of February are as follows:

Name of Company	Gross Earnings for February 1925	1924
American Water Works & Electric	$3,427,122	$3,307,109
Asheville Power & Light	89,757	83,036
Carolina Power & Light	276,028	218,024
Federal Light & Traction	525,400	509,710
Nevada-California Electric	368,758	382,760
Southwestern Power & Light	1,236,522	1,115,361
West Penn	2,284,814	2,271,058
Winnipeg Electric	459,553	479,509
Yadkin River Power	194,360	164,777

Des Moines Utility Stages Successful Campaign.—The Des Moines Electric Light Company recently conducted a successful local campaign which resulted in the sale of 4,040 shares of the company's 7 per cent preferred stock at $100 a share. The campaign was directed by M. G. Linn, vice-president and general manager. The proceeds realized from the stock sale will be devoted to the financing of the big power plant now under construction just outside the southeast city limits on the Des Moines River.

To Pay Dividend in Stock.—Owing to the favorable reception given by stockholders to dividend distributions payable in stock made by other leading public utility companies, the directors of the Associated Gas & Electric Company at a meeting held April 10 authorized payment of the dividend payable May 1 in class A stock at the rate of one-fortieth of one share for each share held of record at the close of business on April 10. In order to accommodate stockholders who may desire cash the company will pay at the rate of 50 cents in cash per share.

Annual Report of International General Electric.—The annual report for the year 1924 just issued by the International General Electric Company, Inc., shows that orders booked during 1924 amounted to $17,590,000, as compared with $21,743,000 during the previous year. This decrease in part was due to the elimination of orders received from the Dominion of Canada. As was announced in its last year's report, the General Electric Company acquired a majority of the common stock of the Canadian General Electric Company, Ltd. Since the early part of 1924 business with the Dominion of Canada has been carried on by the General Electric Company. Sales billed during 1924 aggregated $22,590,108, as compared with $22,371,526 during 1923, this result being due to the completion of orders carried over from the previous year. The competition referred to in last year's report, principally from British and Continental manufacturers, resulted in a reduction of profit from selling operations from $967,506 for 1923 to $690,371 for 1924.

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stocks is $100.)

Companies	Bid Price Saturday, April 11	Low 1925	High 1925
PREFERRED STOCKS			
Operating Companies			
Adirondack Power & Light 7 per cent	99	98	102
Appalachian Power, 7 per cent	97½	92	100
Arkansas Light & Power 7 per cent	93	92	98
Asheville Power & Light 7 per cent	a 99	99	100
Central Illinois Public Service 6 per cent	90	84	93
Colorado Power 7 per cent	94	93	98
Connecticut Light & Power 7 per cent	106	105	110
Consumers' Power 6 per cent	91½	90	93½
Dayton Power & Light 6 per cent	92	88	100
Duquesne Light 7 per cent	a107½	105	107½
Eastern Texas Electric 6 per cent	100	100	105
Empire District Electric 6 per cent	78	78	85
Fort Worth Power & Light 7 per cent	a101	100	102
Great Western Power 7 per cent	98	...	...
Illinois Northern Utilities 6 per cent	88	82	92
Illinois Power & Light 7 per cent	94	92½	98
Kansas Gas & Electric 7 per cent	a 98	98	100
Long Island Lighting 7 per cent	102	100	105
Minnesota Power & Light 7 per cent	a 96	96	98
Mississippi River Power 6 per cent	90	87½	92
Nebraska Power 7 per cent	a 98	98	100
Niagara Falls Power 7 per cent—25	28½	28	29
Niagara, Lockport & Ont. Power 7 per cent	105	101½	110
Northern States Power 7 per cent	97	95	100
Ohio Public Service 7 per cent	96	96	100
Pacific Gas & Electric 6 per cent	94½	92	97
Pacific Power & Light 7 per cent	a 98	98	100
Penn-Ohio Power & Light 7 per cent	93	91	100
Pennsylvania Power & Light $7—no par	a101	100	101½
Penn. Public Service 7 per cent	90	90	100
‡Philadelphia Electric 8 per cent—25	38½	38½	45
Southern California Edison 8 per cent	118	115	122
Tennessee Electric Power, 6 per cent	81	80	84
Texas Power & Light 7 per cent	a100	100	101
Utah Power & Light 7 per cent	a 98	97	99
Western States Gas & Electric 7 per cent	89	82	89
Yadkin River Power, 7 per cent	a 99	98	100
Holding Companies			
American Gas & Electric 6 per cent—100	85	85	89
American Light & Traction	95½	93	97
American Power & Light 6 per cent	85	84	90
American Public Service 7 per cent	91	88	94
American Public Utilities 7 per cent	87	87	95
American Water Works & Electric 7 per cent	100	100	103
Associated Gas & Electric 7 per cent—1 per cent extra—no par	a 51½	...	...
Carolina Power & Light 7 per cent	101	100	105
Central Indiana Power 7 per cent	89	88	95
Cities Service 6 per cent	81	80	83
Commonwealth Power 6 per cent	81½	80	82½
Consolidated Gas 6 per cent—50	58½	57½	59
Continental Gas & Electric 7 per cent pr. pf.	91	89	95
Electric Bond & Share 6 per cent	102½	102	104
General Gas & Electric—$8—no par	109	104½	111
*Middle West Utilities 7 per cent	96½	91½	98½
National Power & Light—$7—no par	95	95	99
North American 6 per cent—50	48½	46½	49
Public Service Corp. of N. J. 7 per cent	a 99½	99	102
Public Service Corp. of N. J. 8 per cent	109½	108½	112½
Standard Gas & Electric 8 per cent—50	51	...	...
‡United Gas Improvement—50	57¼	56¼	58½
United Light & Power—$6.50—no par	81	81	88
COMMON STOCKS			
Operating Companies			
Adirondack Power & Light—50	49	31	52
Appalachian Power—no par	77	70	83
Arkansas Light & Power	75	65	85
Brooklyn Edison	a130½	120½	133
Buffalo General Electric—no par (new)	51	44	51½
*Commonwealth Edison	134½	134¼	139
§Consolidated Gas, Electric Light & Power	34½	32	35¼
Dayton Power & Light	420	180	460
Detroit Edison	a114½	110	119
|| Edison Electric Illuminating of Boston	202	200	206
Long Island Lighting	65	60	85
Mississippi River Power	39	37	42
Montana Power	a 66	64½	72
Niagara Falls Power—no par	57	45½	58
Niagara, Lockport & Ontario Power—no par	60	60	73
Northern Ohio Power	6½	5	7½
Northern States Power	108	103	110
North Texas Electric	60	60	70
Pacific Gas & Electric	105½	102½	108½
†Penn Central Light & Power—no par	63	60	64½
§Pennsylvania Water & Power	129½	126½	133½
‡Philadelphia Electric—25	39½	38½	45½
Public Service Co. of Northern Illinois	114	97	116
Puget Sound Power & Light	49	49	58
Southern California Edison	105	102	106
Tennessee Electric Power—no par	51	47	61
Virginia Power	60	60	92
Virginia Railway & Power	a 91½	64½	91½
West Penn. Co.	110	105	120
Holding Companies			
American Gas & Electric—no par	69½	69½	80
American Light & Traction	143	139	153
American Power & Light	53	52	67
American Public Utilities	74	70	85
American Water Works & Electric	a 46½	34½	49
Associated Gas & Electric, Class A	a 28½	...	...
Carolina Power & Light—no par	330	290	350
Cities Service (new)	35	34	43
Columbia Gas & Electric—no par	a 57½	45½	59
Commonwealth Power Corp.—no par	110	106	126
Consolidated Gas—no par	a 78½	74½	78¾
Continental Gas & Electric	80	80	90
Electric Power & Light	15	14½	15½
Federal Light and Traction	a139	114½	148½
General Gas & Electric	78	72	82
Lehigh Power Securities—no par	92	82	116
*Middle West Utilities—no par	94½	82½	102½
National Power & Light—no par	242	185	246
North American—10	a 45½	41½	49
Philadelphia Co.—50	a 52	51½	57½
Power Securities—no par	13	...	...
Public Service Corp. of N. J.—no par	a 67½	62½	72½
Standard Gas & Electric—no par	a 45½	40½	47½
United Gas & Electric (Conn.)—no par	28	26	37½
Utah Securities	a 70½	41½	70½
BONDS			
Operating Companies			
Adirondack Power & Light 6s	1950	104½	102½ 105
Alabama Power 5s	1946	97½	96 98
Appalachian Power 5s	1941	96½	96 97½
Brooklyn Edison 5s	1949	100½	99½ 100½
Cleveland Electric Illuminating 6s	1930	105½	104½ 105½
Commonwealth Edison 5s	1939	100½	100 101½
5s	1943	100½	99½ 101
5s	1953	99	98½ 99½
Consol. Gas, Elec. Lt. & Pwr. 4½s	1935	96½	93½ 97½
§6s	1949	106½	104½ 106½
Consumers' Power 5s	1936	99	99 99½
5s	1952	94½	90½ 95½
Detroit Edison 5s	1933	101½	99½ 102½
Duquesne Light 6s	1949	106	104½ 107
Great Western Power 5s	1946	97	95 97½
Kansas City Power & Light 5s	1952	97½	95½ 96½
Mississippi River Power 5s	1951	98	96½ 99
Montana Power 5s	1943	99½	97½ 99½
New England Power 5s	1951	100½	100½ 101½
New York Edison 6½s	1941	114½	112 115
Niagara Falls Power 6s	1932	105	103½ 105½
Northern States Power 5s	1941	95	93 96½
6s	1941	104½	103 107½
Ohio Power 7s	1951	106½	106½ 107½
Pacific Gas & Electric 5s	1942	95½	93½ 96
Pennsylvania Water & Power 5s	1940	100	99½ 101
‡Philadelphia Electric 5s	1966	100½	100½ 102
5½s	1947	105	103½ 105
6s	1941	107½	106 107½
Portland Electric Power 6s	1947	96½	94 99½
Southern California Edison 5s	1939	99	99 100½
6s	1944	103½	102½ 104½
Tennessee Electric Power 6s	1947	101½	99½ 102½
Texas Power & Light 5s	1937	96½	96½ 98
Toledo Edison 7s	1941	109½	108½ 110
Utah Power & Light 5s	1944	93½	91 95½
Holding Companies			
Alabama Traction, Light & Power 5s	1962	89	86 90
American Gas & Electric 6s	2014	96½	96½ 97
American Power & Light 6s	2016	95	94 95½
Amer. Water Works & Electric 5s	1934	95½	92½ 96½
Associated Gas & Electric 6½s	1954	a100	... ...
Central Indiana Power 6s	1947	97½	95½ 98½
Commonwealth Power 6s	1947	100½	97½ 101
Consolidated Cities Lt., Pwr. & Tr. 5s	1962	79½	75½ 80½
Illinois Power & Light 6s	1953	101	100½ 102
United Light & Railways 5s	1932	94	93½ 94½
6s	1952	97½	95½ 99½
ELECTRICAL MANUFACTURING COMPANIES			
PREFERRED STOCKS			
Allis-Chalmers Manufacturing		104½	103½ 107
Worthington Pump & Machinery A.		a 82	79 88
COMMON STOCKS			
Allis-Chalmers Manufacturing		a 79½	71½ 86½
American Bosch Magneto—no par		a 32½	26½ 54½
Electric Storage Battery—no par		a 64½	60½ 70½
General Electric		a274½	227½ 320
General Electric—10		a 11½	11 11½
*Hurley Machine—no par		43½	41½ 56
†Wagner Electric		33½	26½ 50
Westinghouse Electric & Manufacturing—50		a 69	66½ 84
Worthington Pump & Machinery		a 51½	45 79½
BONDS			
General Electric 3½s	1942	83½	83 84
5s	1952	104½	101½ 105½
Robbins & Myers 7s	1952	65	65 73½
Western Electric 5s	1944	99½	98 99½
Westinghouse Electric & Mfg. 7s	1931	107½	107½ 108½

*Chicago Stock Exchange. †St. Louis Stock Exchange. ‡Philadelphia Stock Exchange. || Boston Stock Exchange. §Baltimore Stock Exchange.
a Bid price, low and high, Tuesday, April 14.

Business Facts for Electrical Men

Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

New Financing a Test of Activity and Growth

PERHAPS one of the most reliable barometers of activity and progress within an industry is to be found in the new capital requirements of that industry. Growth requires new manufacturing and distribution equipment, new housing and very often the acquirement of new properties, all of which call for large sums of money.

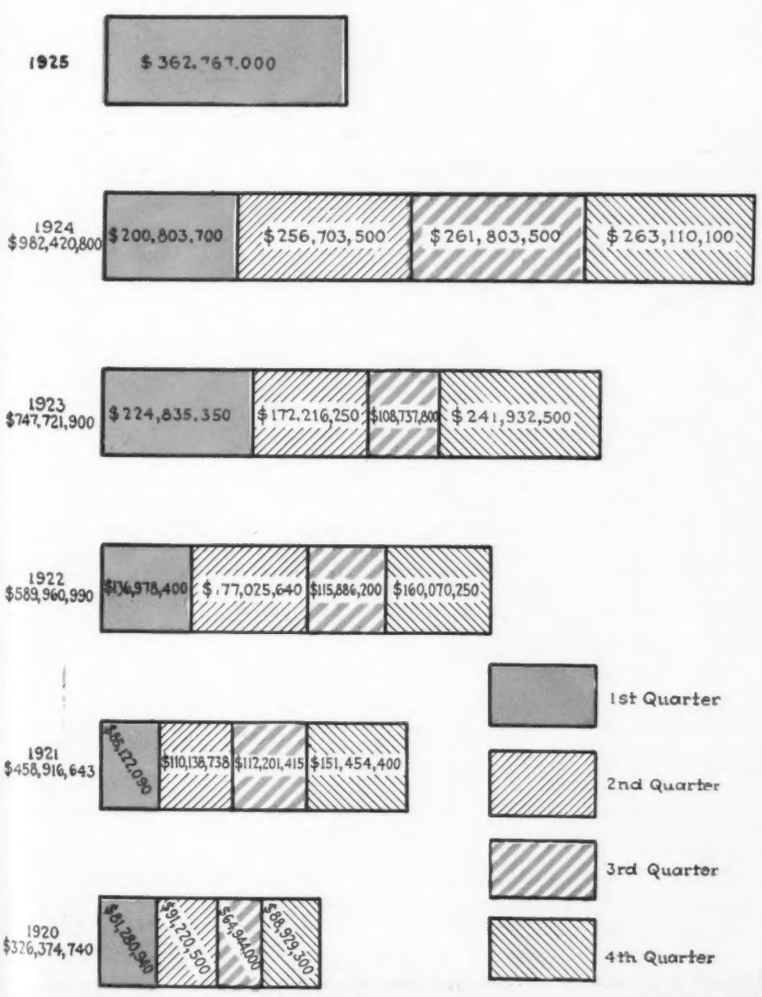
The gradual increase in the financing of the electric light and power companies of the country is but a reflection of the growth of that industry. Since 1920 the annual financing of the industry has more than tripled, and the total sales of electric light and power securities during the first quarter of 1925 give every indication that the security sales for the present year will exceed those which have occurred in any former year.

One of the outstanding facts concerning the financing of the industry is that fully 90 per cent of money borrowed is to take care of growth within the industry, and this is also largely true of the telephone industry. With the older industries, however, such as the steam railroads, a very large proportion of the financial requirements is to take care of depreciation and obsolescence. The electric light and power industry is so young and its growth has been so rapid that the time has not yet arrived when comparatively large amounts must be spent for new equipment necessitated by depreciation.

In studying the data given in the accompanying diagram it must not be forgotten that a certain portion of these amounts was for refunding purposes. This sum amounted to $223,000,000 in 1924. Also it must be remembered that the figures shown in the diagram do not include local sales which were made by electric light and power companies direct to their customers and employees, which in the year 1924 totaled $197,000,000.

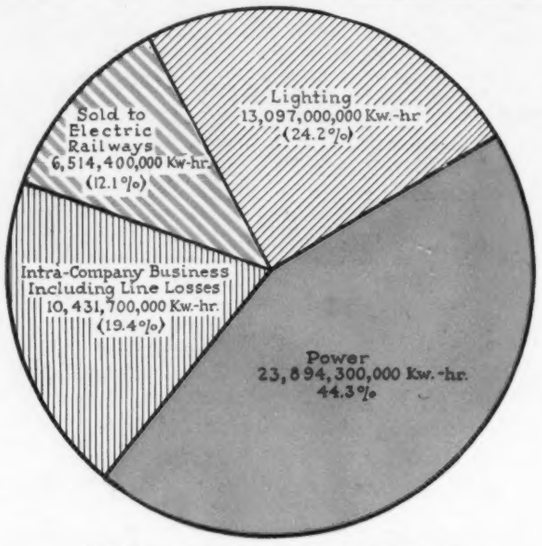
New Financing of Electric Light and Power Companies During Past Few Years

Does not include sales by electric light and power companies direct to customers and employees

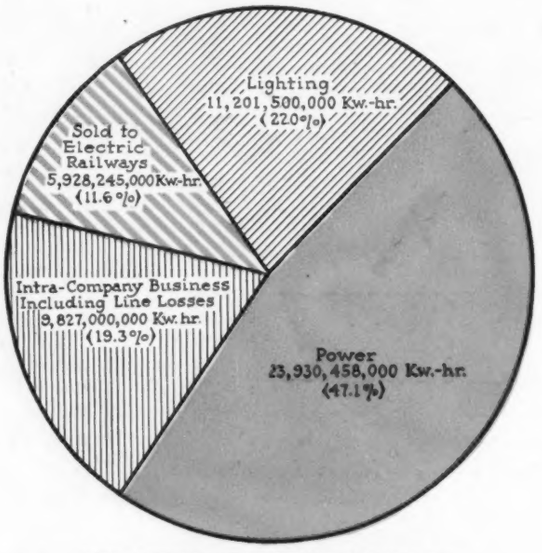


Most of the data for statistics in the ELECTRICAL WORLD are gathered by it from original sources. Privilege is freely given to readers of the ELECTRICAL WORLD to quote for use these statistics for any legitimate purpose. While there is no requirement that the source of data be given, yet it would help the ELECTRICAL WORLD in obtaining and compiling further basic information if those who make use of these statistics would give credit to the ELECTRICAL WORLD.

Distribution of Energy Generated by Central Stations in the United States



1924-TOTAL=53,937,400,000 KW.-HR.



1923-TOTAL=50,887,203,000 KW.-HR.

Energy Sales as Business Barometer

THERE are today several acceptable indicators of general business and industrial activity. Iron and steel production, car loadings, building construction, bank clearings and security sales and prices all have advocates who extol their value as indicators of national business and industrial operations. Since the war, however, another reliable business barometer has come into being in the consumption of electrical energy for industrial power purposes. Business depression is reflected in decreased sales activities in general merchandise, which in turn are reflected in decreased manufactures, and these in turn are again reflected in decreased energy requirements for industrial power purposes. There is, of course, a certain amount of lag between decreased buying by the public and decreased production, but, taken over an extended period, it will be found that sales of energy for industrial power purposes follow very closely the business activity of the country.

The curtailment in manufacturing activities during the first half of 1924 resulted in a decided drop in electrical energy consumption by power customers of central-station companies, taken as a whole. The 1924 energy consumption by power customers of central stations was approximately 36,000,000 kw.-hr. under the total for 1923. But it must be remembered that approximately 56,600 new power customers were added to the central-station lines during this twelve-month period, so that the actual decreased energy consumption due to curtailment of manufacturing activities is not made apparent in the total energy consumption figures for the year. If it were possible to deduct the energy consumption by the new customers added during 1924, a very good picture would be obtained of the general industrial activities of the country.